

In this Issue
THE SOVIET AIR FORCE —
ONE YEAR OF WAR
By Lt. Col. Nikolai Denisov

AUG.
1942

AVIATION

The Oldest American Aeronautical Magazine

McGraw-Hill Publishing Company, Inc.

Price 50c. per copy



B-26's Speed to the kill!

Army B-26's, equipped as torpedo bombers, recently destroyed a Japanese cruiser and damaged a carrier off the Aleutian Islands.

Driven by two 2,000-horsepower Pratt & Whitney Double Wasps, Martin Marauders combine the blinding speed of fighters with the striking power of bombers.



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ONE OF THE THREE DIVISIONS OF

UNITED AIRCRAFT CORPORATION, East Hartford, Connecticut

FOR NAVIGATORS who must get the DRIFT...fast!

Contrary winds can do a lot of blowing across the course of a bomber on a mission. It doesn't take much unexpected drift to miss that pin-point objective on the chart. Hence the need for the highly skilled navigator who is such an important member of the typical American bomber crew.

Kees men deserve precise instruments. And our Service navigators get them. With the Pioneer Drift Indicator, an important member of "The Invisible Crew," the navigator is able to make quick, accurate observations of drift, ground speed and altitude. He finds the Drift Indicator an important member of the Pioneer group of precise navigation instruments—a group working day and night to bring security to our planes—and insecurity to our enemies.

PIONEER INSTRUMENT DIVISION,



PIONEER INSTRUMENT DIVISION

Products of the Pioneer Instrument Division are important members of "The Invisible Crew," and the family problem-free instruments and appliances made by the Bendix Corporation, serving with our fighting crews on every front.

THE INVISIBLE CREW

Bendix

ANALOG CORPORATION

★ ★ IN THIS ISSUE ★ ★

WHETHER AT WAR or at peace, the progress and strength of a nation is measurable in terms of its research effort. On page 36, the editors urge that we use our ideas as we research aviation; that appropriations be sufficient to sustain continuous research in our progressive laboratories, and that research be encouraged to increase and speed the research program for the good of the nation.

Its spread radio signals from Mexico means a report (page 36) by Lt. Col. Nelson Deane of the Bureau of Aeronautics on how the air power and an account of why the Luftwaffe failed on its aerial assault.

The third of a series of articles on fighter boat design by Capt. Frank T. Courtney (page 38) compares the fundamental design shortcomings of landplanes and wingmen with respect to maximum sporting efficiency.

The remarkable development of the aircraft industry in Canada from practically nothing at the start of the war to an important factor in Allied production is described on page 39.

A story on how Catalina factories were revolutionized upon conversion of the automotive industry to war makes it on page 40. In applying their modern experience to the aircraft industry, Catalina Corp. has speeded up many steps for a new kind of metal-rod manufacturing factory.

An analysis of the design details of the Japanese Mitsubishi Zero engine which represents an enormous job of development (feature illustration of engine from engine on page 124) is given on page 124.

A comparison of the manual and continuous methods of inspection testing is made on page 125. Steps on page 126 and 127 show that the more rapid and accurate and revealed method has a number of valuable applications.

Further studies can be applied to correct manufacturing with considerable advantage, resulting in maintenance of precision, greater shock and in a limited work of tolerance values. An analysis of the various rubber-coupled and plastic materials for airplane parts is given by Stanley D. Knight on page 128.

Industrial testing is finding wider application in the aircraft industry because of its versatility both as to temperature and area of application. A description of the process is given by J. Wesley Cable on page 129.

Two New Features

Reimagined this month are two important new features for the Aircrew's reader. The first, appearing on page 250, and the second, appearing on page 251, are the Engineering Design Book, which begins a regular compilation of useful technical data for design and production engineers.

The second new feature is an improved New Products section including "Information Type" concerning valuable new literature available to the industry. A statement Request Form is included which may be used by interested readers to obtain the literature mentioned or more information on the products described through Armstrong's Reader Service Bureau (page 158).

In the Military Review (page 181) Miles F. Cross continues his observations of American aircraft as the European warplanes from his vantage point in England. A review of the Japanese, range, firing rate, and valuable arm of four German military planes is given on page 205.

Making motion pictures to be used for training maintenance personnel, both Army and company's representatives, for servicing the Army P-50 Mustang is described on page 207.



NAME IS LAXED Victory manager of Republic Aircraft Corporation was born in England and obtained his present position by coming up through the ranks of the company. His article on the manufacturing methods employed by Republic in England and the supply "breakdown" considered by many to be the world's outstanding fighter plane, appears on page 206.

In the Flying Equipment section a schematic comparison of a Top Zero fighter with similar German and Italian models is made (page 224) and details of the British Spitfire bomber are described (page 221).

Coming

In the September issue of *Aircrew* will appear the first of two articles on the meteorological characteristics of thunderstorms by George N. Bennett of the U. S. Weather Bureau which was scheduled originally for this issue but was unavoidably delayed.

There will be an authoritative article on dynamic air strength and its improvement of hypersonic aircraft production accuracy.

The contribution of the Conquest spirit on warplanes will deal with ball weights, wings, fuselage, and drive. There are no important in the development of design theory that three points where will form a complete and most important statement of the failures of the past and the necessities of the future.

Among the many other features to be included in *Aircrew's* regular departments will be interviews and photographs of the latest aircraft, and a complete description of the British Spitfire. The first of the British Spitfire's and the Luftwaffe and plane production of Britain.



CHARLES ARONSON, President and manager of Eastern Air Lines, is an authority on world events. His article on page 206 tells how transport planes convert to night throughout their service life due to the continuous addition of new safety devices and makes dramatic suggestions for the control of the night.

10 Distinct Advantages OF REPUBLIC ELECTRUNITE

AIRCRAFT TUBING



Illustration by John Thompson

Because it is made from flat-rolled steel, cold-formed to tubular shape and then electric resistance welded, Republic ELECTRUNITE Aircraft Tubing offers ten distinct advantages—many of them not considerably obtainable by other processes.

1. Uniform Dimensions
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The 10th advantage is superior freedom from all injurious defects—insured by test of every length by a special test.

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daily-developed non-destructive electric method.

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Learn to Fly...for Your Country ...for Your Future!



Take Your Instruction in the Plane
in Which Most of the American Pilots
of Today Earned Their Wings...the
PIPER CUB TRAINER

A future pilot is in the air—immediately in the production of gliders, pilots and mechanics, later in the aviation industry so important to the nation's economy after victory is attained.

Your future, too—in the Armed Forces at present or in civilian life in years to come—might well be found in flight training now. The pilots who were yesterday's eager students mastering the controls of Piper Cub Trainers are today flying for Democracy on the far-flung battlefronts of the world. To men who fly will go the immense responsibilities of our aviation industry that will be definitely laid in pieces as it won in war.

Learn to fly today, to serve your country and yourself. You can learn in the same easy-to-fly Piper Cub in which most present-day pilots won their wings. It's the plane YOU can fly NOW—wherever you're stationed or away—and it's the predecessor of the Piper plane America will buy and fly by the thousands in the years to come.

Look for the familiar yellow Piper Cub Trainers at your favorite airport. Your Piper Cub Dealer will be glad to give you a flight demonstration and tell you how you can become a pilot now.



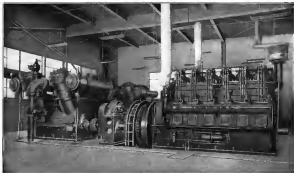
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FREE BOOK ON HOW TO FLY

Send today for your complimentary copy of the easy-to-understand book "You Too Can Fly" And if you want to advance, one of the beautifully illustrated full-color Piper catalogs, we have this in stamps or even for postage-free! Piper Aircraft Corporation, Dept. 322, Lock Haven, Penna.

CP AIR COMPRESSORS MEET VARIETY



← **PORTLAND AIRPLANE PLANT** secured made air plus power production with two CP Diesel-driven V-CE compressors. Side pressure telescoped between compressors and engine for

emergency power service. CP noted double-acting air pumps designed for contrast, heavy duty operation, are available in double-acting type in 175 to 1000 horsepower.

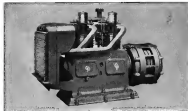


HORIZONTAL STRAIGHT-LINE TANGOR two stage compressors in another aircraft plant. Type T-CE Compressors are available in two-stage and three-stage sizes and motor-driven models, 50 to 100 horsepower, for pressures up to 2200 lbs. per sq. in.

← **SYNCHRONOUS MOTOR-DRIVEN CLASS B CE** Industrial Diesel Compressor in machine tool manufacturing plant. Simple, efficient, two-stage operation makes the unit for most air work. Synchronous motor-driven class B-CE Compressor are available in sizes from 75 to 1000 horsepower.



OF WAR-TIME PRODUCTION NEEDS



← **WATER FLOOD SPACE IS LIMITED**. In 1914 the first compressor, compact, low power consumption, two-stage, air-cooled, double-acting built in electric motor, had drive as flexible coupling. CP 1914 Compressor are available in 25 to 75 hp.



← **SAPPER INTACT**, quickly installed with only a single integration foundation. CP Type "T" Compressor allows the pack line at the covered plant that uses three additional air capacity, heavy duty double-acting type 75 to 1000 horsepower.

BECAUSE OF ITS ANNULAR PORTS and straight section 100 the straight valve pressure the general effective area for a given valve diameter. Result is low air velocity, minimum valve clearance, low power consumption and high volumetric efficiency.

A TYPE AND SIZE FOR EVERY PLANT REQUIREMENT

Belt, Motor, Steam or Diesel Driven

NEW YORK (CPI)—The wide range of CP Air Compressors and the diversity of sizes and types are emphasized in recent installations in war-production plants.

An eastern aircraft company installed two CP 1850 cu. ft. Diesel-driven compressors. Another plane manufacturer selected CP synchronous motor-driven horizontal-double machines. In smaller plants—and for a number of services in larger industries—the single acting vertical and horizontal straight line types are filling a varied range of requirements.

Write for data on the complete line of Chicago Pneumatic Air Compressors.

CHICAGO PNEUMATIC TOOL COMPANY

General Office 1 E. 14th St., New York, N. Y.



CHICAGO



PNEUMATIC

AIR COMPRESSORS

ALSO: Pneumatic Tools, Electric Tools, Rock Drills, Hydraulic Aviation Accessories, Diesel Engines

FORWARD
ECONOMY
AND LOW
MOTOR POWER
EQUIPMENT
FOR YOUR
PLANT

A THUNDERBOLT forged for VICTORY



The LOCKHEED "LIGHTNING" P-38 *Outpoints and Outflies its Enemies*

ON

NORMA-HOFFMANN
PRECISION BEARINGS

So swift that it approaches the speed of sound—so maneuverable that it outpoints and outflies its enemies in battle—so powerful as to maximize its full performance at high altitudes—the Lockheed "Lightning" P-38 Interceptor-Pursuit Plane is said to be one of the world's fastest fighters. And **NORMA-HOFFMANN PRECISION BEARINGS**—used in the controls and at other vital points "where the bearings MUST *sync* fast"—contribute smoothness and instant response, speedability and dependability, to these swift planes serving in the U. S. Army Air Force and in the Royal Air Force.

In practically every type of American built fighter and bomber on every fighting front, as in the trainers and transports behind the lines, **NORMA-HOFFMANN PRECISION BEARINGS** are rendering unflinching service "on land, at sea, and in the air".

Write for the Catalog. Let our engineers work with you.

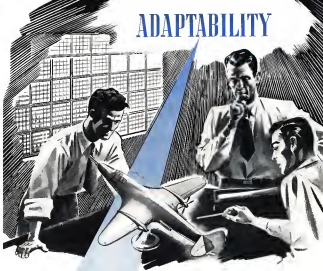
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FOUNDED 1917

PRECISION BALL, ROULER AND THRUST BEARINGS



ADAPTABILITY



...never more necessary than now

Modern war is a war of movement. Theaters of conflict change constantly... requiring altered tactics and new strategies, adapted to changing conditions. And changing needs may call for newer, better aircraft. Right now of course—present production is all important. That's why at McDonnell, we're straining every effort, working to the limit of plant capacities in the production of *precision-built* aircraft and parts for our armed forces. But our designers and engineers are also looking constantly to the future... working toward tomorrow's needs.

MCDONNELL AIRCRAFT CORPORATION
SAINT LOUIS



OUR PARACHUTE FLARE RACKS MAY AFFECT **your** BUSINESS!

Twenty-four hours a day, 7 days a week we are rushing out Parachute Flare Racks... one of many parts we are supplying to America's war effort.

To be able to do this and deliver them on time or ahead of schedule, as we have, a Spriesch modern war production method has been developed. It has achieved a production of war material with the lowest percent of rejection!

When the democratic peace comes, turn this modern fabrication ability to the battle for private business and what have you got. YOU will have a valuable source for a wide variety of experimental work.

Our entire equipment of latest type machines and tools, heat treating and physical testing apparatus plus our long experience will be at your service. **Plan now to use it.**

Parachute Flare Rack for releasing parachute egress flares for lighted landings. Made of alloyed metal stampings, welded assembly.



Spriesch
Established 1911

TOOL & MANUFACTURING CO.

JOSEPH J. CHERRY, President

10 Howard Street

Buffalo, New York

NOTICE!
Since Dec. 7, 1941
our Proving Grounds
have been located
**SOMEWHERE IN
THE PACIFIC**



★ On the flight deck of a great aircraft carrier at Diamond Head, in a lightning fast patrol squadron soaring through racing mists above the Pacific... on giant bombers and alien patrol ships. These are the places where fire fighting equipment may meet its greatest vital test. These are the Proving Grounds for the extinguishing systems of the future.

Every man who flies a warplane knows that he can place confidence reliance in his Kiddie Extinguishing System. If the time for instant

action ever comes, he knows that a quick yank at the control cable will blast Kiddie carbon dioxide snow-and-gas into his nearest compartment... will kill fire in split seconds, with a blizzard that's more death to flames.

Kiddie will snuff out the fires of wartime as surely as it has always stopped this threat in days of peace. Kiddie is sure-handed, dependable. Kiddie is in the war—up to the hilt!

Good luck... He's on hand!... Keep 'em flying!

Walter Kidde & Company

882 West Street



Stamford, N. J.

FAMILIAR NAME ON



NEW ASSEMBLY LINES

NOW it's almost impossible to find a machine "used to grow" or a plan that cannot be changed over to new production. The man on the assembly line has seen the changes taking place—and after another.

One thing, though, hasn't changed—namely "changed over" to new production. In the Torrington Needle Bearing, wartime production men recognize an old familiar name. For this unique bearing is proving its adaptability now, in applications where its advantages mean more today than ever.

In case of installation, for example,

is cutting assembly time...reducing power loads in "crush out" areas usually by experienced hands to work with the speed and efficiency war production schedules demand.

Every feature of the Needle Bearing, in fact, is filling some vital wartime need. Its small size is saving space and critical materials; its simplified design is eliminating extra parts and assembly steps; its low coefficient of friction, ensuring smooth performance...high capacity and efficient lubrication, reducing the need for replacement or maintenance attention.

And so it is easy to understand why the Torrington Needle Bearing is in service today on new assembly lines all over America—assembly lines geared to production-for-Victory.

FOR INFORMATION concerning capacities and sizes, send for Catalog No. 124 Or consult your Torrington distributor. He is an expert in solving the Needle Bearing's unique problems in specific problems.



THE TORRINGTON COMPANY
BOSTON, MASS. U.S.A. • Est. 1884

Authorized Distributors and Retail Dealers
Chicago New York
Cleveland Detroit Columbus
San Francisco Portland Seattle Boston

TORRINGTON NEEDLE BEARING

Every feature fills a wartime need.

★ For Faster Fabrication

Time is saved and production increased on sheet metal parts and planes by inexperienced workmen or more fully trained men...through the use of these handy new precision tools.

Aerocraft TOOLS

Duplicating Punches
Made of highest grade tool steel, accurately maintained and recently heat treated 14 mm.



Strip Duplicators
Bending Type

Provides a handy, accurate method of duplicating shapes, holes or notching sheets. Made of spring steel in great stock, with bent edge for prying sheets apart.



Strip Duplicators
Spring Loaded Type

For working sheet stock on the fly, a spring mechanism in the body of the tool gives flexibility for bending plates.



Chip Chasers

Clear waste between sheets after holes are drilled. Oil spray used with the tool. One standard size meets all requirements.



Hook Scrapers

Remove all burrs or roughness from one side of sheet stock. Strongly built—easy to use. Two sizes for all weight sheets.



THIS NEW 50-PAGE AEROCRAFT CATALOG

Illustrates and describes the full line of sheet sets, hole saws, backing bars, angle drills and other Aerocraft Tools. Please make requests on your business letterhead.



Aerocraft TOOLS, INC.
LOS ANGELES - CALIFORNIA



Sure, Joe's Safe!

YOU CAN RELY ON LYCOMING AIRCRAFT ENGINES

"I never worry when Joe's flying the Lycoming-powered Bertha's. The boys in the field, both pilots and mechanics, tell me that you can always rely on Lycoming."

This typical expression of confidence in the U.S.-based Lycoming engines have been used and proved through years of use in Army and Navy training centers and on America's airports from coast to coast. Lycoming is a synonym for engine dependability throughout the aviation industry.

Contractors to the U. S. Army and Navy



THE TRAINING PLANE
ENGINE OF TODAY
THE PRIVATE PLANE
ENGINE OF TOMORROW

WILLIAMSPORT, PA.

AVIATION, August, 1942

Five features on request showing all the values of Lycoming radial and how easily applied radial engines can provide many of the flying general aviation. Write Department of Aviation.

Now A New and Better

Remote Control Circuit Breaker

For fuseless protection of all plane auxiliary motors. Two operating schemes. New safety. New performance. Meets high altitude aircraft requirements.

Once more Cutler-Hammer steps to the front with an outstanding development in remotely controlled circuit breakers for motors on aircraft elevators, rudders, wing flaps, aileron flaps, intercom, pumps, turntables, and landing gear.

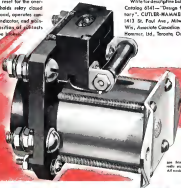
This new contactor provides two separate circuits, two operating schemes, to meet all aircraft emergency requirements.

Scheme One, on a single control wire to the pilot switch, opens and closes the contacts, provides manual reset for the overload relay, holds relay closed against overload, operates contact position indicator, and provides lost position of contacts should wire be broken.

Scheme Two provides automatic reset of overload relay, remote control of opening and closing, holds relay closed against overload, and contacts open should wires be broken.

The new circuit breaker is offered in three sizes—50, 100, or 200 amperes, 12 or 24 volts. Designed specifically for aircraft use, it is safety tested and related to ensure inflexible performance under all flight conditions. No delays—no waiting for development—in production need.

Write for descriptive bulletins Catalog 6541—"Design for Victory". CUTLER-HAMMER, Inc., 1413 St. Paul Ave., Milwaukee, Wis., Associate Canadian Cutler-Hammer, Ltd., Toronto, Ont.



NOTE: Cutler-Hammer also manufactures a complete line of commercial fully automatic pressure switches, solenoids, float switches and valves as well as valves for air lines, including special remote valves. Write for complete literature. All models in production.

1939-1941 25th Anniversary

CONSTRUCTION AND OPERATING FEATURES

- ✓ Minimum weight with maximum strength.
- ✓ Tripping time inversely proportional to full load. Exceptionally fast in short circuits.
- ✓ Unique blowout feature on main power can lock interrupter peak short circuit currents.
- ✓ Provides circuit to make connections in ambient temperatures from -50°F. to +120°F.
- ✓ Tested for operation at 45,000 foot altitude.
- ✓ Two knock, full floating, self-aligning special alloy alloy contacts.
- ✓ Will operate in any position under extreme heat up to 1000°F.
- ✓ Will make disconnection from 25 cycles per second, total maximum of 1000 with up and down direction.
- ✓ Maximum wiring terminal size.

CUTLER-HAMMER

MOTOR CONTROL





The rotor is the heart of every Sperry gyroscopic instrument. In that sense it is the heart of every combat plane.

To produce them faster, Sperry engineers have invented and developed a remarkable machine, the Sperry Sirobasometric Balancer. With it, rotors are now caddowed with perfect dynamic balance eight times faster than before—and in 1/4th the floor space!

The reason this country's production is ahead is the same one which is now beginning to show on the fighting front—superior American ingenuity.

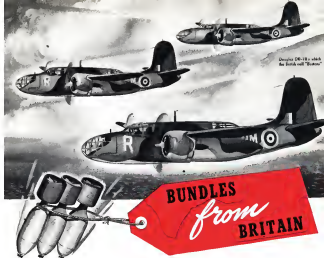
SPERRY GYROSCOPE COMPANY, INC.
BROOKLYN, NEW YORK

Among Sperry products playing a vital role in the war effort are the Gyro Compass, Gyroplane, Directional Gyro, Gyro-Motor and Auto-Airport Landinglight.



RESEARCH SPEEDS WAR PRODUCTION

AVIATION, August 1942



★ These "bundles" are being donated by the R. A. F., and their highly explosive nature is making life pretty miserable for Schickelgruber and Company. ★ The Boston business Illustrated, together with many other American made planes used by the Royal Air Force in their devastating attacks on the Nazis, are equipped with Aerol Struts. ★ It is perfectly natural that Aerol Struts are extensively used on planes being flown by our allies. For Aerol Struts were the first hydraulic-pneumatic shock absorbing struts, the

type now almost universally used in modern aviation. As a result, Aerol Struts have been used on more planes than any other type made. They help to insure safe, smooth landings and take-offs on the fiercest fighters and the biggest bombers.

★ The many years of engineering experience, unmatched testing equipment, and huge production facilities that have given Aerol Struts this enviable leadership, are now devoted to just one job—helping the United Nations overwhelm the forces of evil.

THE CLEVELAND PNEUMATIC TOOL COMPANY
AIRCRAFT DIVISION ★ CLEVELAND, OHIO

CONTRACTORS TO THE UNITED STATES GOVERNMENT

Also manufacturers of Cline pneumatic tools for the aircraft industry, Cline shock absorbers, Cline-Air shock absorbers for trucks and buses, and rock drills for mining and construction work.

AEROL Shock-Absorbing **STRUTS**

FIRST CHOICE OF AMERICAN AVIATION TO KEEP 'EM LANDING SAFELY AND SMOOTHLY



*You can
BEND
and **RIVET** these
*Flexible Plastic Name Plates!**



The Formica Insulation Company • 4628 Spring Grove Avenue • Cincinnati, Ohio

THE "PERMAPRINT" name and direction plates Formica has come-thing to offer the manufacturer who has been requested by the War Production Board to discontinue use of metals for this purpose.

"Permaprint" name plates may be of a flexible type that can be bent to the contour of a curved surface, and can be drilled in place without danger of the material shattering. It is also available in flat, rigid types for flat surfaces.

All lettering is protected by a transparent plastic surface against wear or injury by grease or solvents.

The plates may have a white background and black lettering, or a black background and white lettering. Where it is essential that serial numbers form a part of the plate a strip of aluminum may be inlaid, and into this the serial numbers can be stamped easily by the usual methods.

Formica equipment for this product is large and it is available in full to those manufacturers of airplanes and other war equipment who must use non-metallic name plates.



In this view is the pattern shop at Sports, an experienced pattern maker is mounting a serial pattern on the pattern plate preparatory to the final production specimen of molding.

THE *Art* OF PATTERN MAKING

MUSKEGON
Piston Rings

With the care and precision with which patterns are designed and mounted Muskegon's pattern makers combine experience, knowledge and aptitude which make their calling closely akin to an Art. The result—finished rings of correct shape for their respective uses—Aircraft, Automotive, Diesel, Marine.

Muskegon engineers are experienced in all fields. Their cooperation is available to all who use piston rings.

MUSKEGON PISTON RING CO.
Muskegon, Michigan
Plants at Muskegon and Sports



It can take it!



Here is positive evidence of the Allison engine's ability to survive an Axis daylight — to take a hail of lead and keep flying. Purchased in secret places, this engine carried its plane and pilot back to safety at an R. A. F. air base in Libya. This engine, later returned to this country and now in the "Arms For Victory" Exhibit of General Motors in Detroit, gives dramatic proof that when the Nazis shoot up an Allison they can't count on shooting it down.

It can dish it out!



Curtis P-40 (2) The Warhawk
of the Tussock at the Elmhurst

Qualitative superiority counts! From Africa, the Middle East, the South Pacific, Russia, the communique reports that nothing in the Axis air armada can match the deep-wood thrust of this liquid-cooled engine. It's a matter of record that produces Pearl Harbor, how Allison-powered planes can dish it out.

Roll is smooth, R. A. and
Roll is smooth



Roll is smooth, R. A. and
Roll is smooth

Roll is smooth, R. A. and
Roll is smooth

Allison
DIVISION OF

AVIATION, August 1942

**STOP
THIS!**

Are your War Workers
wasting vital minutes
putting lock washers
on screws?

USE
SEMS
FASTENER UNITS

Now! Get faster assembly on all war equipment where screws and lock washers are specified! With this pre-assembled lock washer and screw unit even green workers can speed up the job! Only one unit to handle — pick it up and drive it — the lock washer CAN'T drop off! No awkward handling — no costly slow-downs — no wasted lock washers — and every screw is certain to be locked tight!

Save office time, too! One pricing and one P. O. covers both parts — inventories always balance and stock records are simplified.

FREE TESTING KIT!

Send for this handy sample kit — contains SEMS Fastener Units in a variety of head styles and types of lock washers. Try them yourself! Write for your kit today!



SEMS FASTENER UNITS • LOCK WASHERS
THREAD-SETTING SCREWS • LOCKING AND
FLARE TERMINALS • COLLING SCREWS
SPRING WASHERS • RADIO AND
INSTRUMENT PLATE • CONE FASTENERS
SPECIAL STAMPERS

SHAKEPROOF Inc.
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Manufacturer of Shockproof Products Manufactured at ELKHART, INDIANA
2025 NORTH KESLER AVENUE • CHICAGO, ILLINOIS
Plants at Chicago and Elgin, Illinois
In Canada: Canada Electric Tools, Ltd., Toronto, Ontario

SUNNEN Solves Another Problem

The Job

Deliver—200" hole, hardened
steel reamed .002" toler-
ance—plus .0007" per .001"
feed—2 to 3 micro inches—
perfectly all parts tested at
Rock Surface Analyzer for white
metal and inspected under Com-
pax, finding nothing
—hard testing

File used by Sunnen Honing
—10/10

"After honing by the Sunnen
Honing Machine we have con-
stantly uniform and more
parts in good through the honing
process. We save time and ma-
terials in use."

—Hobbs Machine Company



**SUNNEN HONING provides
a finish of 2 to 3 micro-inches
—and at a saving of 35% in time!**



Aluminum Engine Parts accurately honed
to .0001-inch finish



Brass Valve, the Sunnen method of
honing is used to obtain a high finish
and accuracy



Aluminum Honing Machine
The Sunnen Honing Machine
The Sunnen Honing Machine
The Sunnen Honing Machine



Engine parts honed by Sunnen
method



Steel Honing Machine
The Sunnen Honing Machine
The Sunnen Honing Machine

Accuracy—and a super-smooth finish with a real increase in
production which means a saving in cost. That's the record of
the Sunnen "WA" Precision Honing Machine in the modern
plant of the Hobbs Machine Company.

This one example is indicative of the many reasons why
hundreds of leading manufacturers handling important war con-
tracts have adopted Sunnen Honing.

Consider These Advantages

Wide range—handles internal diameters of .185" to 2.400".
Accuracy within "one-teeth" guaranteed—has been held to
.000025" on production jobs. Releases big interval grind for
other jobs. Corrects errors of out-of-roundness or taper caused
by previous operations. Facilitates duplication of sizes. Does
not require skilled labor. Practical— inexpensive—economical
to operate.

Put Sunnen Honing to work in your plant!

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An illustration of a Douglas C-47 Skytrain in flight against a dramatic, orange-hued sky. The aircraft is shown from a low angle, with its cargo door open. Several soldiers are visible on the ground, some standing near the aircraft and others in the foreground. The overall scene conveys a sense of military action and transport.

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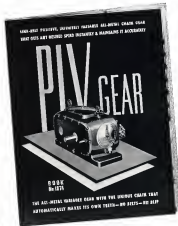
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THE SCHATZ MANUFACTURING CO.
POSSUMTIPSE, N. Y.

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"STANDARD Products—Standard for the Industry"

Airplane LIGHTING Equipment



CABIN LAMPS • DOME LAMPS • RUN-
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LAMPS • SIGNAL LAMPS • VAPOR-
PROOF CABIN LAMPS • CABIN
WORK-TABLE LAMPS • LAND-
ING LAMPS • RECOGNITION
LAMP CONTROL BOXES • IDEN-
TIFICATION LAMP CONTROL BOXES

"Standard" also manufactures Liquid Cooled System Pumps, Roller Valves,
Heater Tanks, Thermostats, Heat Transfer Equipment, Sheet Metal Kitchens,
Ignition Welded Assemblies. Write or wire us regarding your requirements.

STANDARD AIR



STANDARD AIRCRAFT PRODUCTS, INC.
DAYTON, OHIO



ABOVE ALL—SAFETY

PLAIN STATEMENTS OF FACT — ABOUT

Approved T & B Pressure (Solderless) Terminals

STA-KONS

Especially designed for aircraft wiring



HIGH SPOTS

These T & B reliable, feather-weight aircraft terminals take all wires #22 to #14 • Available in all styles and shapes • Special designs for unusual airplane requirements • Sta-Kons are correctly designed for high conductivity • Solderless • Vibration-proof • High pullout value • Inserted fast with T & B quick pressure handtools • Stay fast, making joint as strong as the wire itself • Sta-Kon Bench Tools for rapid production-line assembly • Insulation sleeves if desired • Sta-Kons are made only for War construction • A standard installation on modern military aircraft •

*Made by makers of the famous Weller and Titebond lines of pressure connectors.
For T & B Aviation Catalog with Engineering Data and stock sheets kindly address—*



THE THOMAS & BETTS CO.

INCORPORATED

MANUFACTURERS OF ELECTRICAL FITTINGS SINCE 1899

ELIZABETH, NEW JERSEY

AVIATION, August 1942

"AT's"



AT-17
COLUMBIA "TIGER"



are
powered by

JACOBS Engines

JACOBS AIRCRAFT ENGINE CO.
POTTSTOWN, PENNSYLVANIA, U. S. A.

168-HOUR WEEK FOR POWER AND LIGHT

OUTMODDED WIRING SYSTEMS CAN'T STAND TODAY'S WARTIME PACE! . . . ONLY MODERN BUS DUCT MEETS THE NEEDS OF ROUND-THE-CLOCK OPERATION . . . QUICK PRODUCTION CHANGES . . . LOW INSTALLATION AND MAINTENANCE COSTS

America is winning—but has not yet won—its race against time.

Shipping platforms tell an encouraging story of war production, but the progress of the job must still be measured in terms of time.

Round-the-clock, round-the-calendar operation of machine tools calls for an electrical system that will stay on duty a full 168 hours every week. War plants can't afford to gamble on a single "if."

THESE, IN BRIEF, ARE BULLDOG'S CHIEF ADVANTAGES

Power and light where they are needed, when they are needed.

Systems can be installed in new plants without waiting for machine layout . . . and machines can go to work as soon as the roof is on.

Tool setup can be changed—machines shifted—without interruption of light or power.

Power operates at higher efficiency, with less voltage loss, than in any other system.

The Bulldog Electric Products Company has designed its flexible power and lighting systems with every wartime consideration in mind—efficiency of operation, speed of conversion, economy of critical materials, protection against breakdown and sabotage, saving of installation time, safety of life and property, cost of maintenance.

Power and Light "Stripped for Action"

Who is to say which of these advantages is most important? It is our belief that all are real, if

industry is to reach its victory production goal.

It was because old-fashioned wiring methods could not meet the requirements of modern manufacture that Bulldog pioneered the first bus duct systems many years ago. They are engineered for mass production by mass production experts—and are built by mass production methods.

The same needs that made these systems standard in normal times have made them doubly valuable in this emergency. An hour saved today may well be worth a month in '42.

Bulldog "Plug-in" Power is an Integral Part of the Machine Tools It Serves

Just a moment's pause! That's all the time it takes to hook up the power for any one of the machine tools in the great variety of power plants a wide variety of machine tools, or in other production lines.

For Bulldog Electric Products Company is designed to be an integral part of the machine tools it serves—totally adaptable to any shift or arrangement in production lines.

No delays, no lost production time, no other machine down while any one of them is being moved into or out of the line. Power when you need it, when you want it—and

An extended electrical system, protected against break-downs, sabotage, accidental short circuits.

System is engineered for maximum efficient use of critical materials. Eliminates need for rubber and aluminum. Installation in a fraction of the time required for old-fashioned wiring, with a big saving of engineering time for layout.

Standard, interchangeable sections—100% serviceable. Instantly convertible from one production set-up to another.

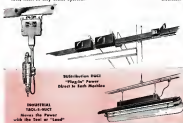
BULLDOG

ELECTRIC PRODUCTS CO.

DETROIT, MICHIGAN

Selling Electric Products of Canada, U.S., Mexico, India

Field Engineering Offices in All Principal Cities



Distribution Rack
"Plug-in" Power
Direct to Each Machine

UNIVERSAL TOOL-LESS DUCT
Moves the Power
with the Tool on "Load"

UNIVERSAL TOOL-LESS DUCT
Plugs in the Loading Area
and Where Needed



BULLDOG "PLUG-IN" SYSTEMS—THE ARTERIES THAT SUPPLY POWER AND LIGHT FOR WAR PRODUCTION



Between You and the Rising Sun

You are looking at a structure that is fast becoming a legend—the majestic ramp of the dorsal fin of the Flying Fortress—known in many dialects, spoken in many languages.

It is one of the reasons why the Fortress is so precise and deadly in action—why it cuts such a long shadow on the hopes of the Axis nations.

The engineers of the Boeing aeronautics division who designed this tall surface were seeking greater structural stability than any airplane ever had. And they worked until they found it.

An airplane with no other than smoothly and steadily on a given course.

Whether the pilot is flying "hands on" or "hands off" the controls, the plane does not "bowl," it does not "yaw," or veer from side to side.

The Boeing fin and rubber cushioning provides straight, smooth sailing for Boeing Stratofoam, and it helps the crew in the Flying Fortress to fit into the work, delivering their messages on time and on the target.

But this is only half the story. For the big Boeing fin also helps to control trouble when trouble strikes in combat. Even if an engine is put out of commission—even with the rubber cushions completely shut away, the Flying Fortress

is a 360-degree control, able to fly on course with and without.

When a big Boeing bomber comes into an objective it must make the mark. The enemy knows this. He has come to know the Flying Fortress well, and to recognize its tell and report for what it is—a symbol of one of the most powerful flying weapons in the world of tomorrow.

The structural safety in aerodynamic design—both for war and for peace—is only one of the many features that form a constant part of the Boeing engineering schedule.

BOEING

DESIGNERS OF THE FLYING FORTRESS • THE STRATOFOUR • THE AMERICAN CLIPPER

THE BOEING COMPANY, 3601 UNIVERSITY AVENUE, SEATTLE, WASHINGTON

AVIATION August, 1942

Sensitive War Instruments Can Be Protected From VIBRATION • NOISE • SHOCK

WITH U. S. ROYAL RUBBER MOUNTINGS



Load-Deflection Characteristics



By protecting the delicate instruments in aircraft, naval vessels, tanks and other vehicles used by the Armed Forces, U. S. Royal Rubber mountings are helping to maintain precision fighting efficiency.

Shown above are three of the standard types selected from the comprehensive line of mountings developed by the engineering staff of U. S. Rubber during many years of experience in the aviation, railway, automotive and machine fields.

If you are faced with a problem of vibration, transmitted noise or impact shock in connection with products used in the war effort, our engineering staff will gladly consult with you in the selection of standard mountings or in designing special mountings.

How To Make Your Mountings and Other Mechanical Rubber Goods Last Longer This Free Booklet, "Fundamentals of Rubber Mountings," is Available Upon Request.

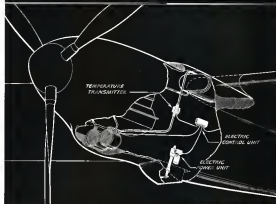


"Service Beyond Price and Specifications"

UNITED STATES RUBBER COMPANY

1120 Sixth Avenue • Rockefeller Center • New York • In Canada: Dominion Rubber Co. Ltd., Toronto, Ont.

Another cut in cooling drag!



— a system designed by AiResearch engineers

AiResearch brings you Automatic Exit Flap Control

1. Closed flaps can often mean 10 to 30 more miles per hour. 2. Automatic flap control provides pilot protection for engines. 3. Relieving the pilot from manual control allows for greater concentration on quality.

To give U. S. military airplanes these three added "edges," AiResearch engineers in cooperation with military engineers have now developed a fully Automatic Exit Flap Control System.

AiResearch's new electrically operated automatic system cuts open flaps when, considering, reduces cooling drag. Its engine oil cooling air overriding pressure control supplements thermostatic control, making this the safest wing system yet developed.

And the simplest. Aircraft engineers designed it to operate without capillary tubes, rhydon bulbs or electronic circuits. AiResearch Automatic Exit Flap Control can easily be adapted to every type of airplane... may be

used on liquid coolant radiators as well as oil coolers.

Successfully flight tested, this light weight system is now in volume production. Military aircraft manufacturers may write or wire for details.



"Where Control Is Best, The Job" • Crank Pressure Regulating Systems • Piston Sealers • Engine Oil Cooling Systems • Engine Air Intakes • Supercharger Airflowing Systems

AIRATION August, 1942

SPARTAN

"O'er the Land of the Free and THE HOME OF THE BRAVE"



America's symbol of liberty on Bedloe Island looms out of the harbor mist as a beacon of hope for all those fighting freedom's battles.

It is Spartan's privilege to play a part in keeping Liberty's torch burning brightly over America. Right now, production of essential war materials for total victory comes before everything else at Spartan.

After the war, Spartan will again produce fine aircraft. Greatly expanded and improved factory facilities, and engineering research already under way, promise an even greater Spartan airplane that will again fly "O'er the land of the free and the home of the brave."

SPARTAN SCHOOL OF AERONAUTICS
a division of the Spartan Aircraft Company, is Government Approved and industry recognized. This "University of Aviation" is acknowledged to be the outstanding aviation school training students in America. Scores of Spartan School's skilled aircraft graduates are serving the Sperry Navy and many others throughout the territory.

SPARTAN AIRCRAFT CO.

TULSA, OKLAHOMA

Contributed to the U. S. Army's Army • Building Since Aircraft Since 1929

As manufacturer of the SPARTAN "Lancaster" quality in the war production program as known as the best of metal private plane in its class. SPARTAN proudly denotes every in the air.

For Example, AIRPORT FIRES..

Boom Nozzle can be raised or lowered, swung right or left, rotated for pivot or direct.

Booms controlled aerial and direct jet from within the cab by a responsive system of joy sticks.

Boom Nozzle can be pointed up, down, and side to side, from within the cab.

Ground Sweeping Nozzle, stationary, discharges forward and down.

Booms Nozzles, on each side, attached in flexible base on each.

When the preformance story of the Cardox Airport Fire Truck can be told, after the war, aviation fires of both aircraft and facilities will originate in great right flames. It is a new chapter in man's conquest of fire. This one, also, is written by Cardox.

Installed in industry's key places all over a Nation based up in high production, Cardox Systems are preventing loss by fire. Cardox is guarding production, as our military forces guard America. But the Airport Fire Truck carries tons of low-temperature carbon dioxide (CO₂) to the spot where a fire is already gaining headway.

This fire truck propels its low-temperature Carbon Dioxide under

complete control from the driver's seat, to beat down high test gasoline flames from above, to sweep the ground as it steadily approaches, to overtake the masses of flames in rolling clouds of carbon dioxide vapor and snow. The frigid breath of Cardox cools down hot metal, extinguishes loss—in water possible a quick return of seepage.

The quality of engineering that produced this truck in close cooperation with aviation officials who keenly appreciated its value, is available for production and property protection, to plants qualified for the service. Contact Cardox immediately. Call your nearest representative to write for Bulletin 2842.

CARDOX CORPORATION
 District Offices in New York • Detroit • Kansas City • Atlanta • Los Angeles
 • BELL BUILDING • CHICAGO
 • Pittsburgh • Cleveland
 • San Francisco

CARDOX

NON-DAMAGING FIRE EXTINGUISHING SYSTEMS

Engineered Fire Truck, Like Cardox Built-In Plant Systems, Brings Revolutionary New Solution to Old FIRE PROBLEM

JUST IMAGINE

This amazing, modern, automatic solution to the old fire problem.

New CARDOX Extinguishes Outdoor Fires

A discharge of liquid CO₂ into the atmosphere in ordinary temperatures vaporizes to carbon dioxide snow and snows down and left right. Cardox methods about 1/2 of the liquid percentage of snow in the discharge, especially valuable in combating oil, tars, even in the presence of wind and fire duty—produces directly in the rest of the fire.

In direct contact with hot and burning surfaces, the snow becomes CO₂ vapor, pulling oxygen aside to create an inert, extinguishing atmosphere, and cooling hot surfaces to prevent re-ignition.

New CARDOX Extinguishes Fires in Built-In Systems

- Fixed extinguishers, as needed, through building piping systems... applied instantly from a single emergency holding tank of liquid Carbon Dioxide.
- Most discharges of Cardox CO₂ "Snows down" fire, by...
- Extinguishing Overhead and Under-structure fires in the immediate vicinity for extinguishing, and before system temperature...
- Extinguishing fire quickly, completely and safely without damage from extinguishing medium.



...FIGHTING PARTNERS OF THE ARMED FORCES

The exciting story of Bendix precision-built equipment sharing in every action of American fighting machines.

"THE INVISIBLE CREW" MARCHES ON AND ON!

A War Report from the Bendix Plants from Coast to Coast



Today, America reads and hears hourly how industry has turned the tide of its production battle. In that battle, it has been a major task of Bendix to develop high precision instruments and apparatus vital to warfare on land, sea, and in the air—and to produce them in quantity. Today, more than 1,000 types of such technical equipment are built by Bendix—built with accuracy and speed.

Our victory and the lives of our fighting men depend on the precision and performance of these devices of war, devices which we of Bendix call "The Invisible Crew."

To match technical brains with the enemy, to put precision into production, to make engineering skill and widespread manufacturing facilities function as an integral whole, this is the objective of the Bendix divisions behind "The Invisible Crew."

Today, Bendix has mobilized its manpower, brain power and production power. We stand fifteen divisions and subsidiaries strong. Many thousands of trained men and women, at work in more than twenty new and enlarged Bendix plants, are helping technical science fight on every battlefield. With typical American pride, we present this Bendix report to the Nation.



BENDIX RADIO DIVISION has been building a complete line of aircraft communication and direction-finding equipment for 6 years. Defense activities brought a 10-fold increase in production, and Pearl Harbor stepped it up still further. These Radio members of "The Invisible Crew" flanked the location of the "Bismarck"—guided flying batteries to sink Philippine bases, aided in our attack on Japan. Bendix Radio is working full-out for fast victory, and for post-war safety and speed in aviation.



ECLIPSE AVIATION DIVISION makes engine starters for today's fighters and bombers. The first Eclipse starters were built for Liberators and B-24s in 1917. Today Eclipse also produces generating equipment to provide current for dozens of aircraft circuits, and Eclipse vacuum pumps operate navigation and door systems. Eclipse oil-air pumps keep propellers ice-free. This Eclipse member of "The Invisible Crew" can make vital to safety as well as speed in military and civil flight.

BENDIX PRODUCTS DIVISION...world's largest brake manufacturer began 18 years ago in 1 building. Developing automotive & wheel brakes, they added aircraft brakes, 3 divisions. Strömberg Injection Carburetors, aircraft landing gear, and automotive brake equipment.



STRÖMBERG CARBURETORS...in 1929 the Strömberg organization joined Bendix. Today's Strömberg automotive, precise metering Injection Carburetors for all levels, altitudes and temperatures are standard on the majority of American planes.



PIONEER INSTRUMENT DIVISION...All-out air warfare brought Pioneer new and varied instrumentation problems. Modern high speeds and high service ceilings, larger planes, higher temperatures presented novel difficulties. Pioneer developed new types of compasses, altimeters, repeaters, remote indicators and created in-flight compass—these and dozens of other Pioneer instruments are being used by Service pilots in ever-increasing quantities as demanded by the war program.



SCINTILLA MAGNETRON DIVISION has developed for Army, Navy and commercial aviation a system of aircraft ignition in step with the newest developments in high altitude and high horsepower operation. The organization that began manufacturing in 1925, with 15 people and an abandoned automobile factory now contains in personnel in thousands and occupies a new and thoroughly modern plant. War spurred intensely has produced a whole new list of Scintilla refinements.



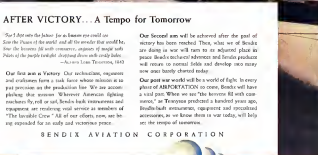
BENDIX LANDING GEAR...contributes to "The Invisible Crew" with airplane wheels and brakes, pneumatic shock struts and steerable tail-booms for military ships, from trainer to bomber class.



BENDIX AUTOMOTIVE PRODUCTS...From the department broker, brake shoes, universal joints and vacuum operated control flow out in volume to join the automotive spirit of our fighting forces all over the world.

BENDIX AVIATION CORPORATION...includes these 15 Divisions and Subsidiaries. DIVISIONS: ★ **BENDIX PRODUCTS DIVISION**, Bendix automotive brakes, airplane wheels, brakes, pneumatic shock struts, Strömberg carburetors. ★ **WAYNE DIVISION**, Aircraft carburetors and landing gear. ★ **ECLIPSE MACHINE DIVISION**, Bendix drive, Morrow counter brackets, Starline, actuators. ★ **MARSHALL-ECLIPSE DIVISION**, Automotive brake lining. ★ **ZENITH CARBURETOR DIVISION**, Zenith carburetors. ★ **MARINE DIVISION**,

Marine propelling, remote controls, indicators. ★ **ECLIPSE AVIATION DIVISION**, Aircraft engine starters, generators, dynamometers. ★ **PIONEER INSTRUMENT DIVISION**, Aircraft flight and navigation instruments. ★ **PHILADELPHIA DIVISION**, Aircraft instruments. ★ **JULIEN P. FREE DIVISION**, Weather and Meteorological instruments. ★ **SCINTILLA MAGNETRON DIVISION**, Aircraft magnetos, spark plugs. ★ **EXPORT DIVISION**, Sale of Bendix products in foreign markets. ★ **BENDIX RADIO DIVISION**, Aircraft radio equipment. **CONSOLIDATED SUBSIDIARIES**: ★ **BENDIX AVIATION, LTD.**, Hydraulic valves, rods, carbon clamps. ★ **HYDRAULIC BRAKE COMPANY**, Hydraulic brakes for motor vehicles.



"Our first step into the future for us began five years ago. We saw the peace of the world and all the wonder that would be, how the heavens fill with commerce, engines of mighty war, pilots of the purple twilight dropping down with costly flocks."
—HENRY LONGFELLOW, 1842

Our first aim is Victory. Our technicians, engineers and craftsmen form a task force whose mission is to put precision on the production line. We are accomplishing that mission. Wherever American fighting machines fly, roll or sail, Bendix leads inventiveness and equipment are rendering vital service as members of "The Invisible Crew." All of our efforts, now, are being expended for an early and victorious peace.

Our second aim will be achieved after the goal of victory has been reached. Then, what we of Bendix are doing in war will turn to its adjusted place in peace. Bendix mechanical advances and Bendix products will return to normal fields and develop into many new and busily charted today.

Our post war world will be a world of flight. In every phase of AIRPORTS to come, Bendix will have a vital part. When we see "the heavens fill with commerce," as Tennyson predicted a hundred years ago, Bendix-built airplanes, equipment and specialized accessories, as we know them in war today, will help set the tempo of commerce.

BENDIX AVIATION CORPORATION

Our first act is Victory. Our technicians, engineers and craftsmen form a task force whose mission is to put precision on the production line. We are accomplishing that mission. Wherever American fighting machines fly, roll or sail, Bendix built instruments and equipment are rendering vital service as members of "The Invisible Crew." All of our efforts, now, are being expended for an early and victorious peace.

BENDIX AVIATION CORPORATION

SENDIX AVIATION CORPORATION

Our post war world will be a world of flight. In every phase of AIRPORTATION to come, Bendix will have a vital part. When we see "the heavens fill with commerce," as Tennyson predicted a hundred years ago, Bendix-built instruments, equipment and specialized accessories, as we know them in war today, will help us see the tropics of tomorrow.

CORPORATION



THE INVISIBLE CREW

PRECISION
EQUIPMENT BY

Bendix

AVIATION CORPORATION

Through the years since *Kitty Hawk*, the support of

The advertisements reproduced on the following pages

Whether it be the need for new airports, the development of commercial air travel and some commercial

The New York Times merits first consideration on the subject of the New American Cinema.

[illegible]

"ALL THE NEWS THAT'S FIT TO PRINT"

HALLOWELL

SHOP EQUIPMENT

• WORK BENCHES • STOOLS • CHAIRS
• FLOOR TRUCKS • TOTE PANS

DON'T BUILD YOUR WORK BENCHES...
SAVE TIME and MONEY! CHOOSE
FROM 1367 "HALLOWELL" COMBINATIONS

YOU are sure to find just the "HALLOWELL" Bench you need—made up, ready to install. No figuring and specifying of multifarious sizes of lumber; no carpentry. There are "HALLOWELL" Benches with shelving; with cabinets; with drawers. Units can be joined for almost any length. There are five leg heights and a variety of widths for your selection.

All "HALLOWELL" Benches are solid as a rock; can be moved around or rearranged and will always set rigidly without costly bolting to floor. All have smooth, splinterproof tops—of steel, Masonite or laminated oil-and-water proof wood using best vital material.

Plant operators everywhere prefer "HALLOWELL" Shop Equipment because it is sturdy and adds greatly to shop efficiency. Write for Catalog—today.



The 131
Type 131
Type 131
Bench in steel



The 132
Type 132
Stool in steel

"HALLOWELL"
STOOLS & CHAIRS

are made in designs to meet every requirement—and with without backs. They have angle legs, rungs and cross of strip steel, pressed into shape and welded throughout for strength, appearance and long life. Integral, slide-away doors. Feet will not scratch or heat. Seats, whether of steel or wood, are dished for comfort.

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA. BOX 546

BOSTON • DETROIT • INDIANAPOLIS • CHICAGO • ST. LOUIS • SAN FRANCISCO



A Simple Blueprint...with a Mallory Complete Contact Assembly ...May Save Many a Flier's Life!

One of the principal manufacturers of variable pitch propeller utilizes electrical contacts to measure changes in pitch. The electrical contact assembly on this job has to be one-fire ... or a pilot can be in the shop before you stop blinking.

Mallory engineers went to work with this aircraft propeller manufacturer's designers when their detailing was still on the drafting boards. Together, Mallory contact specialists and the aircraft engineers developed a new electrical contact assembly, designed for rotary action. Biggest problem was clearance on the revolving contact surface.

Happy solution came when Mallory created a tin-metallic contact assembly incorporating three Mallory-developed alloys with exactly the right electrical and stress-resistant properties.

This example of Mallory's complete contact assembly service can mean plenty to you...if you're planning production of almost any electrically-actuated device. See us before you finish your blueprints. Your Mallory representative is "on call".

Even At Your Elbow! Mallory Contact Catalog.

Complete information on every phase of electrical contact selection, design and action. You need it for your technical library. Write today. No obligation.



P. E. MALLORY & CO., INC., INDIANAPOLIS, INDIANA • Cable Address—PEMALLCO



PE MALLORY & CO. INC.

MALLORY

ELECTRICAL CONTACTS AND CONTACT ASSEMBLIES
NON FERROUS ALLOYS, POWDERED METAL ALLOYS

IS THE CURRENT
AC OR DC ?

WHAT ARE NORMAL
VALUES OF CURRENT
AND VOLTAGE THAT
MAKE AND BREAK ?

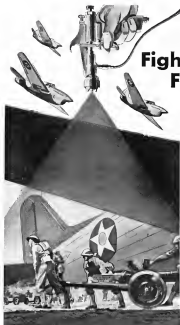
WHAT IS THE ACTION
OF CONTACT BUILDING,
WIPING OR ROUARY ?

WHAT IS THE
ALLOWABLE
TEMPERATURE RISE ?

WHAT OVERLOAD
CONDITIONS MUST
BE SUSTAINED ?

WHAT OPERATING
LIFE IS EXPECTED ?

See
Mallory
for
Contact
Assemblies



Fighting Formulas..

It's perfectly natural that Lowe Brothers should have available a vast fund of current information regarding **FINISHES** formulas—U. S. Government specifications finishes as adapted by all branches of our Armed Forces.

Lowe Brothers have cooperated closely in the development of finishes for war weapons which must fight all sorts of weather, temperature, exposure, impact and combat hazards. And we are supplying Government specification finishes to makers of war weapons and material of every description.

In addition, Lowe Brothers have had years of experience in developing special formulas for an infinite variety of industrial products. When we see, we have compared to stabilize the color and performance of Machine Tool finishes which became the recognized standard of an existing industry.

The chances are that you may need information regarding application data, mixing ratios, drying schedules, bids or such as Government specifications finishes in a hurry—so why not benefit by our experience with industrial finishes for protection and machine products?



INDUSTRIAL DIVISION
THE LOWE BROTHERS CO.
DAVID, OHIO

Lowe Brothers WARTIME FINISHES for Industry

IN ACCORDANCE WITH U. S. GOVERNMENT SPECIFICATIONS



AND MAINTENANCE PAINTS
TO MULTIPLY YOUR MAN POWER EFFICIENCY

-and DELTA AIRLINES



sends them
on their way...
safely serviced
with

Snap-on Tools

Headed and staffed by veterans in commercial aviation, Delta Air Lines — "The Transcontinental Express" — has been serving the Deep South since 1925. Delta, consistently adhering to the most exacting standards of operation and maintenance, holds enviable safety records. Men... and the tools they work with... are the answer!

Son Delta's Superintendent of Maintenance, Carl J. Brock, with 25 years in aviation maintenance, "I have been using Snap-on Tools personally for 20 years, and this since indicates my high regard for these products." Adds Charles E. Bentley, Superintendent of Delta's engine overhaul department, "I have been using Snap-on Tools since 1925... in our exacting work of overhauling aircraft engines quickly but efficiently, there can be no excess. We use highly skilled mechanics, the best materials, and, of course, Snap-on Tools."

Throughout the aviation industry there is common agreement on, and unspoken preference for, the superior speed, accuracy and adaptability of Snap-on tools. Snap-on's 3,000 tools and direct-to-you service are constantly ready near you from 35 factory branches at key aviation centers throughout the United States and Canada. Write for catalog and full information.



Proven method of a "Single Man" on Delta ships. At the right, a Snap-on Vicegrip makes a tight, accurate adjustment.



Admitted master specialist in aviation on his work with the aid of Snap-on tools.



SNAP-ON TOOLS CORPORATION, 8620-H E. 26th Ave., Kenosha, Wisconsin

Taps— 1200 per Minute



Constant speed—
unvarying rhythm—
the first of the
five is used with
the tapping machine.
operation. They are the special advantages
of Quickwork-Whiting Power Hammers.
They insure reliable operation in mass
production from 25 to 500—any time,
and make it easier for him to do a perfect

job. Fast, solid control is accurate, positive.
Quickwork-Whiting Power Hammers
handle work ranging from light mass tapping
to intense, forming and forging opera-
tions on heavy gauge stock. They are rugged,
adjustable machines built for constant hard
work and rough usage. Available in four
sizes with columns, special dies, and pro-
pels as required.

Write for complete information.



Quickwork-Whiting Power Hammers are
widely used in the aircraft industry. This
illustration shows part of a battery of
Quickworks built for one manufacturer.



Use Quickwork-Whiting
Machines to Speed Production

AUTOMATIC Hammers
—available in a com-
plete range of sizes to
tap, form, and shape
steel, brass, and other
metals up to 12"

**STAMPING
HAMMERS**
—available in a com-
plete range of sizes for
forming, drawing, and
other work on a
single piece.

"QUICKWORK" WHITING

Division of Whiting Corporation, 15623 Lathrop Ave., Harvey, Illinois

Aero-Quality

LUMARITH

HELPS
GLIDER PRODUCTION
"OVER THE HUMP"

IMPACT STRENGTH UP TO 1.5 LBS./IN.
LIGHT TRANSMISSION UP TO 92%
SIMPLE CURVES FORMED WITHOUT HEAT

Easy to work in simple or compound curves. Aero-Quality Lumarith gives military aircraft the glider cockpit enclosures, windshields and ports. More transparent than glass... one of the lightest plastics known... a super-tough and shatterproof—Aero-Quality Lumarith resists cracking, is unaffected by gasoline, naphtha, alcohol and other solvents. It is non-corrosive, non-inflammable, impervious to water.

As the founder of the plastics industry, we have experience data not available elsewhere. Our staff of engineers is ready to help you find the best and fastest solution to your plastics problem. For quick action, address the nearest branch office.

Lumarith Molding Powders are used by leading custom molders for extruded and injection molded glider parts.

THE FIRST NAME IN
CELLULOSE ACETATE PLASTICS
FOR GLIDERS AND 'PLANES

CELANESE CELLULOID CORPORATION

Celanese Celuloid Corporation, 110 Madison Ave., New York City, a Division of Celanese Corporation of America. Sole Producer of Celuloid® (cellulose acetate plastics, film base and dope). Lumarith® (cellulose acetate plastics, film base, molding, laminating and transparent packaging material and dope). Lumarith® B.C. (laminating). "Tendrilux" Reg. U.S. Pat. Off. Research Offices: Chicago, St. Louis, Detroit, San Francisco, Los Angeles, Washington, D.C., Lancaster, Montreal, Toronto.

WE'RE SHIPPING SILK
BACK TO JAPAN!

☆ To bring Peace to the mad world, we are sending our Bombers over the "Land of the Rising Sun", manned by American boys protected by "shutes made of silk". Our entire production of parachutes is being devoted to the needs of our Armed Forces. Before the war Switlik Shutes were used by the majority of pilots in the United States, and we are preparing now to accommodate the requirements of a tremendously expanded aviation industry after the war.

How?

By constantly redesigning and improving our "shutes" by incorporating more safeguards, finding better materials, developing better workmanship and lowering the cost. Our specifications are now, and always have been, more rigid and exacting than even those laid down by the war-time Civil Aeronautics Authority.

So, when the last battle has been won, you will find us prepared to meet the needs of America's new army of peace-time pilots.

Respectfully,

John E. Switlik
President

SWITLIK PARACHUTE COMPANY

AMERICA'S LARGEST MAKERS OF PARACHUTES
THIRTON, NEW JERSEY

THE NEW TYPE OF PARACHUTE—"Parachute for Safety"
may be used for a one day drop by day,
or for a long drop by night. It is made
of silk and nylon and is very strong. It is
the standard for the military, and is
used by the majority of pilots in the
United States. It is made by Switlik
Parachute Company,
Thirton, N. J.

BENDIX AVIATION, LTD. RESTRICTOR VALVES

TWO WAY
RESTRICTOR VALVE



Simplify special hydraulic applications

Bendix Restrictor Valves—basically simple in design and construction—are available for restricting the rate of flow in one or both directions of an hydraulic system. The valves are in production and additional orders can be accepted.

The valves can be used to control the speed of retraction or extension of landing gear, flaps, or other hydraulically operated assemblies. They are quickly adjustable while under pressure from no flow to the area of 1/4" tubing.

The unit incorporates a needle-type valve which provides an annular flow passage at the point of restriction, thus reducing the possibility of snagging by foreign matter. Prices, complete with performance data, are available to aircraft manufacturers.

BENDIX  *North Hollywood*
SUBSIDIARY OF BENDIS AVIATION CORPORATION



ONE WAY RESTRICTOR VALVE

DISCONNECT COUPLINGS  POWER BRAKE VALVES  CHECK VALVES  PRESSURE REGULATORS 
HAND PUMPS  ACTUATING CYLINDERS  HYDRAULIC ELECTRIC SWITCHES  RESTRICTOR VALVES 
SEQUENCE VALVES  HYDRAULIC SELECTOR VALVES  TUBE CLAMPS  CUSTOM BUILT RADIO 



5 REGIMENTS

of AERO TECH Graduates
are Helping Fight the War of Production

From the shops, laboratories, and classrooms of Aero Industries Technical Institute an ever-lengthening column of well-trained engineers and mechanics has marched into the battle lines of aircraft engineering and production.

Given training as practical and thorough as actual industry experience itself, these men have together made a significant contribution to the production of superior fighting planes for the United Nations. Many Aero Tech graduates are in key posts, many have contributed valuable advances in engineering and manufacturing techniques.

The large number of Aero Tech graduates employed by some 300 firms in the aviation industry is believed to be a record among aeronautical training institutions giving true vocational and professional training. Their value to the industry lies not in their numbers alone, but also in training that is wing-beating with aeronautical progress.

AERO INDUSTRIES TECHNICAL INSTITUTE
5261 West San Fernando Road, Los Angeles, California



* C. A. A. Approved for Aircraft and Engine Mechanics Training
* Contractor to the U. S. Army Air Force Technical Training Command

AVIATION August 1942



BENDIX AVIATION, LTD.
TAIL LIGHT FLASHER



*Approved for operating
intermittent tail lights
under new C.A.A. regulations*

Completely meeting the new C. A. A. regulations for intermittent and light operation is contained in the Bendix Model 3990 Tail Light Flasher which is now in production.

The Flasher, which combines accuracy with long, trouble-free operation, is a light weight unit of rugged, simple design. The flashing mechanism produces 40 red and white light cycles per minute. Any deviation from this count is immediately corrected by the white light continuously.

All circuits in the Flasher are shielded to prevent interference with radio equipment.

Tungsten points are used in the flasher-circuit.

The center unit is enclosed in a dust and moisture proof container yet inspection is quickly accomplished by removal of one wing bolt and a single AN plug. The Flasher draws only six watts and can be supplied for 12- or 24-volt systems. The unit weighs 2 1/2 pounds and measures 4 1/2 x 3 1/2 x 6. Increase of the approaching deadline for installation of this equipment makes orders should be placed as soon as possible.



BENDIX  *With Delco*
DIVISION OF GENERAL MOTORS CORPORATION

TYPEWRITERS - TYPING MACHINES - COMMUNICATIONS EQUIPMENT - RADIO SETS - COMM. PARALLEL - JAZZ MUSIC - ANTENNA SYSTEMS - MICROPHONES
BATTERY SYSTEMS - RECHARGEABLE BATTERY CHARGERS - INTERCOMPARISON FILMS - OBSERVATION DEVICES - REMOTE CONTROL SYSTEMS

STOP IT where you want it with new Bassick TRUCK LOCKS



IN RETRACTED POSITION FLOOR NEARLY AMPLE CLEARANCE



IN LOCKED POSITION THE TRUCK IS HELD SECURELY IN PLACE

EASY TO APPLY —

one foot motion

★

EASY TO RELEASE —

one foot motion

★

LOW COST —

eliminating need for expensive center brakes

★

OUT OF THE WAY —

under the truck, but always accessible

This new positive position truck lock provides a vital safety control for mobile equipment—floor trucks, scaffolds, portable power tools, portable assembly units, etc. It's a natural for the aircraft industry, and all other plants having a variety of uses involving mobile production equipment.

The model illustrated is designed to be fastened to a surface 7½" above the floor. Special adaptations and applications will be made available for large installations.

WRITE FOR ILLUSTRATED FOLDER GIVING COMPLETE DETAILS

KEEP 'EM ROLLING ON

Bassick Casters

BRIDGEPORT, CONNECTICUT

WORLD'S LARGEST MANUFACTURER OF CASTERS



AVIATION, August 1942



*The B.F. Goodrich
Airplane of the month*

GRUMMAN "WILDCAT"

"WILDCATS" OVER WAKE ISLAND made history for the Marine Corps . . . as they did west of the Gilberts for the Navy. This Grumman F4F pursuit ship, which can be either carrier- or land-based, has already won its service stripes in Donkey's battle. B. F. Goodrich supplies the "Wildcat" with Stevenson tires for safer, smoother landings whether on the parch-

ing deck of an aircraft carrier or on a shell-toned military field. Grumman has long been making fine ships for our Navy and so the master B. F. Goodrich salutes Grumman, maker of the fast F4F pursuit known as the "Wildcat."

The Navy flies with
B.F. Goodrich
FIRST IN RUBBER

B.F. GOODRICH RUBBER RESEARCH FOR THE

A Aviation industry



Synthetic Rubber that conducts electricity lengthens life of De-Icers!

NATURAL RUBBER is a poor conductor of electricity, and when such an insulator is moved rapidly through the atmosphere, static electricity is generated on its surface. Back in the years of early De-Icer development, thousands of volts accumulated on the De-Icer surface and could not be dissipated. In fact, the easiest way it could remove was to puncture a hole in the De-Icer surface and go to the next wing benefit.

De-Icers operate by being refueled with air, creating them to pulsate and crack the ice so that it can be carried away in the slipstream. The man-made holes actually shortened De-Icer life.

So B. F. Goodrich engineers tackled the problem. They developed a synthetic rubber coating which would conduct electricity more readily. They sprayed a thin layer of this material on a polished metal surface and then built the De-Icer against this film.

When the finished De-Icer was removed, ready for installation, it was protected against static punctures.

Electrostatic charges no longer accumulated on De-Icers, giving them added service life. Radio reception, too, is improved, since the static is silently dissipated.

Other advantages were gained by the addition of this synthetic layer. Perhaps the most important is the added protection from sunlight and from oil thrown back from the engines. That fact adds even more service life to today's De-Icers. Another example of B. F. Goodrich research!

Designers and engineers are invited to write for the new De-Icer Handbook, a technical data book especially written for their help. For information on De-Icers and other products, ask for our general catalog. The B. F. Goodrich Co., Aeronautical Division, Akron, Ohio.

MAKERS OF B. F. GOODRICH TIRES AND OVER 80 RUBBER
AND SYNTHETIC RUBBER PRODUCTS FOR AIRPLANES

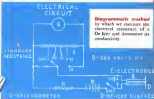


Information from B. F. Goodrich ON DE-ICER CONDUCTIVITY!

Gold Foil Test, as simple as any performed on a high school physics class, demonstrates whether such De-Icer allows an electrical charge to pass over it. When the charged electroscope touches the De-Icer, the gold foil moves only if the charge is conducted away over the surface of the De-Icer.



Recently B. F. Goodrich has developed an improved conductivity test which has increased conductivity and conductivity. As a result, the De-Icers pulsating tubes have still greater recovery and longer life.



The Navy's PB2Y-2 is just one of the ships that will be the way for Uncle Sam, equipped with B. F. Goodrich De-Icers to give faster protection in all kinds of weather. The static conducting De-Icer surface is particularly important in these boats that depend so much on efficient radio performance.





TINY TRAINERS AND 4-MOTOR BOMBERS
are doing their "ground work" on B. F. Goodrich Silverstone Tires. These tires have been developed to help pilots make take-offs, reverses take-offs and landings. Their rugged construction makes them especially well suited for today's ordinary operations. Their dependability makes them the choice of America's leading commercial airlines. Airplane Silverstones are available with both smooth and non-skid tread designs.



**BRIAR
GROUND-CONTROL**
is achieved by plants equipped with B. F. Goodrich Expander Tires. The expansion of the brake causes braking fluid to fill a synthetic rubber expander tube. This tube expands forcing the brake blocks into tight contact with the entire circumference of the brake drum, bringing the plane to a smooth, safe stop.

B. F. Goodrich

AERONAUTICAL DIVISION

AKRON, OHIO



REACHING GEAR
discs, rollers and brake shoes are made by B. F. Goodrich for use in planes. This equipment makes a plane to draw a plane out of the water by making a counterweight to use a dolly. Many important military planes are now being equipped with these B. F. Goodrich products.

Dear Pop:

Even as old Rainbow Rider goes home you would put your eyes at the wing as we're putting together this time. Let us tell you, they're doing everything to make up just about the best bunch of fighting pilots you ever saw.

and that goes for what they do for us off duty, too. You know how tight-knit we are just outside of camp. It's not religion, damn it, it's just a fact. Share and everything. And, Pop, you can get something to eat that won't cost you a month's pay!

Now, the way isn't running this. The way is. And what of the other camps get 100 a piece too, because you and a lot of other fellows are down and gone for many to the last year.

But, Pop, you know what's happened since then. Guys've been streaming into service. Last year there was less than 2 million of us. This year there'll be 4 million. And the way it looks a lot more people to serve that way was—around 25,000,000. Thanks I know.

Now, Pop, I know you agreed with what you would just say. But it would sure be swell if you could dig into the old book again, maybe you could get some of the other folks in the neighborhood stand up, too.

It will mean an awful lot to the fellows in camp all over the country. Start at home, 'em home, 'em home, 'em home. And, Pop, an old soldier like you knows that's a mighty nice feeling for a fellow to have. See what you can do, huh, Pop?

Bill



Send your contribution in your local USO Committee or to National Headquarters, USO, Empire State Building, New York, N. Y.

THIS SPACE CONTRIBUTED BY THE BQ CORPORATION

AVIATION, August, 1942

87



... in ever increasing numbers

We are proud of the fact that our products are included in the construction of the powerful fighting airplanes of the Army and Navy. As reports filter back from the fronts, the knowledge that we are helping to keep these planes in the skies serves as an inspiration to both the workers and the management of our Organization.

BUY WAR BONDS AND STAMPS!

UNION AIRCRAFT PRODUCTS CORP.
Manufacturers of Junction Boxes and Conduit Fittings for the Aircraft Industry
NEW YORK, N. Y.

SERVING THE UNITED NATIONS' AVIATION INDUSTRY, MILITARY SERVICES, GOVERNMENTS AND PEOPLES

New- The Entire World's
PLANES, ENGINES, AIR ARMAMENT,
STATISTICS AND BUYER'S GUIDE

171

AEROSPHERE-1942

The International Aeronautical Authority

Now- the Biggest Publishing Value
in Aviation History

In a world it was THE NEW AEROSPHERE-1942 is more vital than ever! You'll want to keep up-to-date on everything in aviation... for today's aviation is the world's most rapidly moving force... And exclusively and authoritatively AEROSPHERE-1942 gives you, in pictures, drawings and a million facts the whole story... the whole world's battle planes, commercial planes and private planes... the engines big and small that power them... the arms and gunnery that make them deadly and give them precision. AEROSPHERE-1942 also has: The Buyer's Guide has the world's standard international aeronautical authority

Contents:

MODERN AIRCRAFT—152 pages in the second alone... presents all the latest planes and modern planes of the whole world. Hundreds of photographs and drawings. Complete descriptions of design, construction, equipment and performance.

MODERN AIRCRAFT ENGINES—Complete... international in scope. Of special interest are the engines that power today's powerful war planes! Includes with photos, drawings and description of design, construction, equipment and power performance.

AIRCRAFT ARMAMENT—Shows and describes the guns and armor plate used by the world's modern battle planes (all modern battle aircraft material). The series gives the reader a broad understanding of machine gunnery, armor and shells used in aerial combat.

STATISTICS—Wholly world aviation records and international adjustments in general, major aeronautical classification... statistics, rates, statistics, construction, government, business, etc.

BUYER'S GUIDE—List of the whole world's aviation industrial firms alphabetically (with address and personnel), by products and (the U.S.) geographically. List of buyers and sellers. Also a national guide!

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It is the fact that the world's most rapidly moving force... the whole world's battle planes, commercial planes and private planes... the engines big and small that power them... the arms and gunnery that make them deadly and give them precision. AEROSPHERE-1942 also has: The Buyer's Guide has the world's standard international aeronautical authority



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ROHR Presents--

San Diego "Firsts" in Aviation History



First Seaplane Flight ~ 1910

One of Aviation's proudest beginnings took place on a foggy Spring morning in 1910. With few witnesses except his own helpers, fearless Glenn Curtiss settled himself comfortably on the lower landing edge, turned his coast collar up and his cap around - and proceeded to raise his motorized box kite off the waters of San Diego Bay and into history.

SAN DIEGO'S early achievements in Aviation stand as lasting tribute to the vision, courage and ingenuity of its pioneer figures. ★ Our cherished objective, as we serve today's industry, is to carry still further that great tradition.

ROHR

AIRCRAFT PARTS & ASSEMBLIES
AIRCRAFT CORPORATION
SAN DIEGO ★ CALIFORNIA

AVIATION, August, 1942



Your Scrap Iron and Steel is Needed Now!

★
**6,000,000 EXTRA TONS MUST BE
OBTAINED TO KEEP WAR PLANTS WORKING**

We've got to win this war. To win it, we must have equipment. That takes steel—millions of tons of it. And to make the steel, more scrap is needed.

look around your plant or shop. Any old machines, line shafting, pumps, gears or other obsolete, broken or worn-out equipment—any old dies, jigs, templates, rolls, potteries, molds, tools or fixtures—any old pipe, valves or hardware—old autos and trucks—anything made of iron or steel that you can dig up or tear down will mean more tanks, airplanes, ships, guns, shells and other armament.

Many millions of tons of scrap iron and steel will be turned back to steel producers this year

BUT IT WON'T BE ENOUGH!

6,000,000 EXTRA tons are *urgently* needed—because, on the average, every ton of open-hearth and electric furnace steel produced today is made up in half by scrap. The steel industry must get that quantity to produce the steel required to keep war production plants running full nose this fall and winter.

Start a special scrap gathering campaign *today*, with a competent man or committee in charge. Tell every man in your plant about it—for his job, his home, even his life, may depend upon it. Post this story on your bulletin boards (we'll gladly send reprints). You'll be surprised how much EXTRA scrap iron and steel you can find in your plant and at home, too.

Then call your nearest junk or scrap dealer. Sell it to him, and he'll move it along to the steel mills.



This Advertisement Sponsored by
REPUBLIC STEEL CORPORATION
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In Cooperation with the U. S. Government's Salvage Campaign

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Every piece of Airchox coined and forged Parachute Harness Hardware is manufactured from specially rolled steels to the exacting specifications of the UNITED STATES AIR FORCE.

AIRCHOX COMPANY



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The following manufacturers of parachutes for the U.S. AIR FORCE use AIRCHOX FITTINGS

American Lady Carpet Co.

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Precision Pays

By giving America the world's best aircraft, Martin bombers have given our high fighting qualities on every fighting battle front. Performance of Martin bombers around the globe is a tribute to the care and skill of Martin workers.

Martin B-26 Bomber—

CHECK! Taylor group, plus inspectors, double-check, make sure that landing gear and body is perfectly correct before to take the stress of landing.



PRECISION is today's pride to battle. The skill of the men who fly is wasted without the skill of the men who build. One flaw, perhaps invisible to even the trained eye, may cost America thousands of man-hours worth of equipment. One moment of carelessness or inattention may cost America a victory. Over two thousand Martin inspectors can't be wrong!

In Martin plants you find every possible device to insure accuracy. But the dependability of Martin Aircraft rests upon the eyes, brains and hands of the inspectors who use that equipment. More than keen vigilance is demanded of these men and women. They must have determination as strong as the strength they build... determination to remain alert every second... determination to give the men on the fighting front weapons second to none.

Born of such determination, painstaking care and unerring accuracy have made Martin Aircraft world-known for dependability since 1909.

THE GLENN L. MARTIN COMPANY
Baltimore, Maryland, U. S. A.

Over 2000 Martin Inspectors Can't be Wrong!

INSIDE STUFF: Under wings, nose, interior, fuselage, wing interior, or other important place in various settings and large spaces immediately adjacent to the fuselage.

EAGLE EYE: An eagle's keen vision is in chief officer's brilliant vision magnified 20 times. Real live Eagle is at all angles position around wings.

TELL-TALE: Inspectors in structural inspection get the going from the Martin Inspector who is that telling exact info by as much as the balance of the inspection group.

PREENING TAIL FEATHERS: Control surface and set precisely in relation to the fuselage. Inspectors use a special tool to verify the angle of incidence.



Martin AIRCRAFT

Builders of Dependable Aircraft Since 1909



*L*ance spread says that the great drum of St. Francis Drake is heard in a resounding call to men whenever Britain's fleet hoist her. Today the roar of aircraft engines carries the echo of Drake's drum as the forces of the United Nations gather their strength for attack. Flying fleets of Brewster Bronco for Britain and Brewster for the U. S. Navy are striking the Axis with smashing weapons to blast the enemy.

Brewster

FIGHTERS AND DIVE BOMBERS • FOR LASTING MASTERY OF THE AIR

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Ask leading local wholesalers for Bunting Bronze Standardized Bearings. Completely machined and finished. Ready for assembly. Available from ready stocks in sizes providing quick, easy, economical production and maintenance of machine tools, electric motors and all kinds of industrial mechanical equipment. Also readily adapted to many special applications.

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WHOLESALED BY ALL PRINCIPAL STORES



Bunting Standardized Bearings are from the grade of B.B. and, the bearing has one standard for bearing characteristics of all types of machines.



Bunting
BRONZE BEARINGS • BEARINGS • PRECISION BRONZE BARS

NO FUTURE IN FLYING?

THAT'S AFTER the pictures on this page, note the taken there were those who believe there was no future in living. "Why play with a dream?" "Why defy the law of gravity?"

Why? Because there is hope to a few, this is a beautiful sight to behold. I can't be done, so just use principles, new ideas, new materials.

One of the components of new materials that is currently construction is plastics. One of the most kinds of technical plastic is known

Polysiloxane is a thermosetting plastic available in its light weight (half the weight of aluminum), resistance to corrosion from chlorine salt and gasoline, water and ozone, and structural strength, excellent electrical insulating characteristics, ease of machining, and resistance to changes in shape with changes in temperature. Typical polysiloxane films from DuPont are shown at the bottom.

SYNNAME CORPORATION, ORAS, PA.



IN CLEVELAND 4, Buach, two-seat observation plane, also produced in U.S. during World War I and powered with 400 h.p. Liberty engine. Later modified and used as air mail courier and for establishing air routes.



LINCOLN TEACHER, one of the most famous of American schoolroom jobs, in her classroom at Cedar Rapids High School. Her pupils are shown in the foreground.



THIS IS THE WAY they started in 1945. Since the phone had no self-starters, several pairs of hands, hot and strong arms, were required. Usually four or five women were necessary to make contact.

THE AVIATION INDUSTRIES
OF SYMBIONE

graduates the amount of time

UGWT WEIGHT with Structural Strength
 10GT WEIGHT with Corrosion Resistance
 10GT WEIGHT with High Dielectric Strength
 10GT WEIGHT with Ease of Machining

**SYNTHANE
TECHNICAL PLASTICS**

SYNTHANE
habitable - Nominatores

Source: Author. Notes: Adapted from: *Journal of Management Education*, 2000, 24(1), 10-12.

Materials to remember specify and use for aircraft parts

FUNCTIONAL FLEXIBILITY



Designed particularly for the aircraft industry the 650-350 ton Hydro-Dynamic Double Action Press features:



Speed change—by position—by pressure.

Revered—by position—by pressure

Strokes of each slide adjustable

Relative stroke adjustable.

Operation as Single Action press of 1000 tons capacity.

Operation as a "So-Called" triple action using the cushion.

Operation of cushion as ejector

Independent pressure control on each cushion pad.



Similar presses can obtain increased speeds up to 500%.

Additional information is available in the author's manuscript.



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STATISTICS August 1967

CAPITAL_TYPES

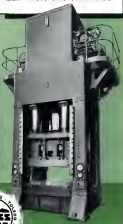
Capacity of frame	1000
Capacity of punch die	400
Capacity of blankholder die	200
Capacity of cushion	100

03/04/2014 14:00:00

End area F to E X R to L	63x74
Culture pods—two each	24x32
Dry and lift-out capacity	14
Maximum block size	50x58
Maximum punch size	40x60

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Quick advance to work	450
Feeding	300
Return	275



BLISS

Fountainhead of PLASTICS EDUCATION

As a comprehensive source of practical plastics information, Plastics Institute has an established program to serve industrial organizations most efficiently—in full recognition of its responsibility as the Fountainhead of Plastics Education. The Institute offers Basic Lessons in

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Over uncharted seas and trackless wastelands, the American Eagle is winging to the fight: Striking Farther!—Higher!—Faster!

Precision control, more than ever is a key to air supremacy. Precision control means more striking power, longer distances, increased fire power, heavier bomb loads, more frequent flights.

VARD engineers and skilled workmen are building a number of types of actuating controls, precision inspection gages, navigation instruments, and optical goods used on Allied bombers and fighters the world over. These planes, with these controls, are outperforming the enemy in action.

VARD is helping to increase the striking power of our aircraft.

VARD is helping to make the American Eagle stronger.

VARD INC. PASADENA,
CALIFORNIA

HERE'S A *Kitty* THE JAPS DON'T LIKE!



Official U. S. Navy Photograph

It's the Grumman "Wildcat"—the Navy's highly maneuverable, death-defying carrier-based fighter! In more than one-day battle the Japs have had their ears pinned back by the expert handling of these great fighters. In our eyes, fight, one "Wildcat" downed six Jap fighters, crippled another and returned to its base undamaged. Such performance is the result of perfect coordination of a ship's power plant, guns and control mechanisms. Controls must respond to instant demands—without friction—without drag—without fail. This is another wartime job for Fairchild Aircraft Ball Bearings.

Fairchild Ball Bearings for Aircraft date back through the experimental era of the "hotshot" era, the same engineering spirit that built the great American aviation industry found in our laboratories, our testing rooms, and in our plants. From the beginning, Fairchild Aircraft Ball Bearings have been an important part of the aviation industry. Today, "Fairchild on the controls" has become the inward wherever Uncle Sam's aircraft is built—from Flying Fortress to B-29 Superfortress, the Fairchild Bearing Company, Aviation Division, New Britain, Connecticut.

FAFNR
Ball Bearings
for Aircraft
Engines and Controls

Look for many Fairchild Aircraft Bearing Division, you will find it on thousands of service units.

SIX THINGS

IMAGINEERING

SO MUCH
SO SOON

A MAN CAN DO

I MAKE OUR OWN JOB MORE PRODUCTIVE. Every man jacks of us can. And that's not preaching, either. It's the punch of new we've adopted for the duration at Alcoa. The records we've broken so far, we tell ourselves, won't nearly good enough. Nor shall we be satisfied with the new ones we set tomorrow.



II MAKE OUR MACHINES MORE PRODUCTIVE. There is a way. We don't know the answer for your equipment. But we have found the answers for many of our own machines which we thought were already up to top output. The resulting step-up is getting pieces into the air faster. And it is doing things to aluminum prices. Designers please note.

III PRACTICE PREVENTIVE MAINTENANCE. Keeping present equipment in top condition is easier than getting new. One of the ways our engineers are helping production everywhere is in consulting users of aluminum equipment on means of preventing unnecessary corrosion. The remedy is usually simple, the results priceless. Ask us.

FOUR BUY WAR BONDS AND STAMPS. It's patriotism with self-interest. You finance the war and you help to defeat inflation by refusing to spend for nonessentials. Moreover, you finance yourself to take advantage of all the revolutionary new products that are going to be ready to buy when the war is over. Buy today to keep your own wheels turning tomorrow.

FIVE DREAM A DREAM EVERY DAY. Remember that the kind of peace we all want depends on how many jobs we think up for the boys coming back. New jobs come out of new things to make. Let your imagination soar; engineer it down to earth, then file the plans away, ready for the day when. That's Engineering! Soberly suppressive, think seriously in terms of Alcoa Aluminum.

Sixth and last KEEP THE OLD CHIN UP. Whatever the news, whatever the temptation, keep the chin up. The boys out there deserve it. Whether it's relaxing, or meditation, or whatever, let them watch us bring soldiers about that.

Alcoa Aluminum Company of America, 2183 Gulf Bldg., Pittsburgh, Pa.

ALCOA ALUMINUM



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This Douglas C-119 Flying wheel has a carrying capacity of over 40 tons. It weighs 2 brakes, 8 inches wide.



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THE INVISIBLE CREW

Illustration

Bendix
AVIATION CORPORATION

BENDIX PRODUCTS DIVISION
of Bendix Aviation Corporation

South Bend, Indiana

Eternal Research is the Price of Victory

A SHORT TIME AGO the Luftwaffe came over the battle lines with a new type of fighter plane, the Focke-Wulf 109, which represents a new phase in German design because it is powered by a radial, uncooled engine. The powerplant is the BMW 801 engine which develops 1,500 hp. at take off and 1,400 hp. at 14,500 ft. Reports from front lines say that a highly efficient cooling mechanism increases this power output considerably.

In spite of this important advance by the Germans, our radial uncooled engines remain the best and most powerful in the world. We have passed the 1,600 hp. stage, and we are well on the way to higher outputs with an immediate ceiling in sight. But engines of this class are not developed or placed in production overnight. Each time the output of an engine is advanced, new problems appear in the design of superchargers, propellers, and even spark plugs and other accessories and refinements and the technology of tests and techniques used keep pace with the pace of progress. Each increment of power output requires the coordinated effort of many engineers and research workers not only of the engine manufacturer's staff, but in the laboratories of the field and necessary subcontractors, and in the government laboratories where basic research work is done. And many specialized problems must be solved in the design of aircraft to fit the new engine. One of the most important of these is finding the ideal compromise between cooling and cooling air streamlining. The engine, the engine and propeller, and all of these parts must be developed in unison to achieve the ultimate performance of the integrated unit. That is also research and development work kept going continuously and without interruption if we are going to win this war.

One moment, no matter how unimportant, and developed research demands facilities at numerous key points before the war. While the National Advisory Committee for Aeronautics struggled for six years to open after years, the Germans had built up their DVL, to transmute progressions, many times outstripping our government laboratories in personnel. When the Dalmatian realized the importance of basic research, a higher degree than our Congress, when they made exhaust tunnels to build the aerodynamic city of Göttingen—an entire community devoted to aerodynamic research. And the Japanese, who are not industrially considered a sensitive people, supported their aerodynamic research in April, 1938, by a 5-year program in the Central Aeronautical Institute outside Tokyo, which paid. In spite of our financial hardships of the past, our research work has been done on outstanding job and it is reflected in the superiority of many of our designs. The efficient evolution of radial uncooled engines is not new to us by any means. As far back as the late '30s the NACA had developed the cooling that beat its race. Work on this basic problem has progressed without interruption in the laboratories of government and industry since that time, and

a very complete collection of data on this subject is available in our design engineers. This is only one example of a research project well done. There are many others.

No one in any country has found a shortcut to the several years of mature development required between the conception of a new design and the quality production stage. In a development involving so many unknown factors it is unlikely that this period will ever be materially reduced. And we may as well face the cold hard fact that so important nations, including ourselves, has a larger share of talented talent and ingenuity than the others. It is therefore probably apparent that we must be continuing in our research and development work if we are to retain the superiority in various phases of design that we have struggled to achieve.

To guard against any interruption in the continuous work of progress, is the joint responsibility of the government and the industry. Congress must never again play political football with the established government research laboratories, and, second, as we in a private, should it be considered essential to reduce their appropriation in the point where their activities are curtailed. In its irreducible minimum for testing, profit out of war, Congress must recognize that design development by manufacturers is an expensive but necessary step in the process of engineering progress and must provide the substantial for its sustenance. It must be remembered that most of our industrial achievements so far have been paid for out of profits from export business and that this method of raising our development out of the hands of the private of the Lindbergh Act. And it is the responsibility of the industry to pursue its design development work aggressively and wisely, regardless of the temporary emphasis on price production, to that the new advances of the basic research organizations will be incorporated in new and improved products in quality in possible.

All of these things can happen any day—and doing very effectively. The new German engine is only a single example of the many advances engineering developments that are fighting forces will have to face. In the particular instance we are asked by a remarkable margin. But in no instance are we faced to meet on our heels. There is no price too high for us to pay in order to retain our leadership.

Yoshi E. Hanks



AMERICA AT WAR



LEFT: Four-engine components of the aircraft engine include planes such as these—(from top to bottom): Douglas C-124 Constellation transport; Pratt & Whitney F4U Corsair fighter; and Brewster F2A Buffalo fighter. (Inset) added to this aircraft is the Grumman Avenger torpedo plane (see AVIATION July) which attacked the Japanese at the war at Midway.



RIGHT: The aircraft carrier now replaces the battleship as the backbone of the fleet in the country. It now constitutes the most effective means of carrying the war to the enemy in the sea.



OP MEANT INTERPRET in another people in the war of the war. Allied arms was frequent changing systems. But the Axis is still suffering the same attack, the same weapons, in Russia, China, and in America's Far East states. The Axis dominates the English Channel and Australian front. But of these fronts are contained completely by us.

—Battling us war is the right expression. For the Axis has its strength, made out. Real victory is the Axis jump to us, and the Axis commands know this if they don't get a long lead before, then, the Allies will be after them with more but less than they can make.

That is to say, our Army and Navy expected that despite the rising cost of the latest weapons. I am forced to personally depressed about our efforts, but not the less, our. They know it was wrong. Of course, they are not happy, for the destruction of life and property is all the real victory of the war.

The Axis does not write in American production figures. Aircraft output has risen to a point where the information just the contrary, then, it helps him, so the President has set ourselves a goal of nearly 4000 a month. Our aircraft output is only about 1000 (about 1000 per day). In total, which includes 100,000 aircraft, 1500 tanks, 2000 aircraft, and 100,000 guns, 100,000 of 3A guns. Our deposits have actually increased 10,000 on factory ships in 10 days, from the day of last month.

In a word, the Axis will be forced to make a kind of American production. That long it will take depends on many things, but it is sure. If you're very close to us in terms of power, then the Axis will be forced to make a kind of American production. That long it will take depends on many things, but it is sure. If you're very close to us in terms of power, then the Axis will be forced to make a kind of American production.

The Axis has only 10 million tons of steel per year, to fight the Allies' 120 million tons. That means, and is, the major factor in the war. But, in the European and other theaters, the Axis has only 10 million tons of steel per year, to fight the Allies' 120 million tons. That means, and is, the major factor in the war. But, in the European and other theaters, the Axis has only 10 million tons of steel per year, to fight the Allies' 120 million tons.

In Washington, the war has moved out of our place into another. The political process is now in the hands of the war, and the production process is now in the hands of the war. The political process is now in the hands of the war, and the production process is now in the hands of the war. The political process is now in the hands of the war, and the production process is now in the hands of the war.

That's the general picture.

Naval Picture

The nation can handle in military matters its relation to our power. In the House of Representatives, as a bill was passed appropriating money to build 500,000 tons of new aircraft carriers, Carl Vinson, chairman of the Naval Affairs Committee and spokesman in Congress for the Navy, said that the Navy was in full agreement with the Committee's action in not providing for any new battleships. The Navy felt it was that it couldn't afford to build any more battleships.

This Committee does not claim any prophetic powers, but on Nov. 1, last January, did say it looked as if the sea was going to be a certain war. When that war started we had seven

carriers, and alone building, which will make sixteen, more than the Japanese. The 100,000 tons per carrier will add up to sixteen in 20 and 30 days. The great total would make a ship build as fast as the ship that was built before.

But it is really possible that further shifts in the weapons of our navy come before our navy's strength will have been built. In support of such a possibility we have the word of no less than four Admirals: William H. P. Stand, chief of the Navy Bureau of Ordnance. The Admirals say that, undoubtedly, the airplane has replaced the battleship as the strong force of the Navy. And we know that the whole program is a continuation of our navy's strength, and it is not in that we are in a position of transition from carrier-based to aircraft-based completely land-based.

At every moment, however, the transition is a process of progress, and the design of ship-based airplanes is a process of progress, and the design of ship-based airplanes is a process of progress, and the design of ship-based airplanes is a process of progress, and the design of ship-based airplanes is a process of progress.

It should be noted that construction of battleships has not actually stopped. Some statements are made that such as some ship-based construction has been stopped, but other statements indicate that it will not stop. It will not stop, but other statements indicate that it will not stop. It will not stop, but other statements indicate that it will not stop.

One of the big aircraft plane manufacturers will certainly, in the production of aircraft, and the aircraft ship has been built for 10 years, and the production is, or will be, that it took all this time to go battleships from the production of our way.

The same man expressed his opinion that carriers will be a very useful purpose during the war, and the construction of them should be made with all speed. But, he said, that period will pass quickly. In six or seven years, in the interim, long-range land-based airplanes will put the carriers out of business. He pointed out the value of ships based flying boats, which never find themselves attacked in the air because the enemy has landed their base.

Isair Glibers

Only a few weeks ago both Army and Navy told Congress they felt that the location of gliders in this country's strategy was limited. It seemed that the glider program was small, and experimental. Now, suddenly, the Army has a big glider program and the Navy is going to build up.

The main reason for this change of heart seems to be our army. Not long ago, the military shipping situation got so bad that the Army initiated a vast air-cargo program, ordering large numbers of aerial cargo airplane designs, and most of them are now in production. The Army is now in a position to build up its air-cargo program, and the Navy is now in a position to build up its air-cargo program.

However, pilots of all three services to maintain an experience, especially when they felt that numbers were on their side. But the performance was soon shattered by the Soviet pilots who displayed their own skill, an apparent, superior style of aerial warfare. During the initial stage of the present war, the same bravery and flying skill of the Soviet pilots served completely to refute the German doctrine of aerial warfare.

Hard Vertical Finns

The Nam strategy was directed at planning their own operations. They seemed to have taken account of every thing, even including the most favorable time for attack. They chose the moment when the Soviet air force was partly in process of reinforcement and had not yet started all new types of machines. The latest jet was unable, at high speed, to follow and destroy the older fighters and bombers that made their

type (one of three models) is used in the Navy and done at least twice. Many pilots find it resembles themselves in their own shape and study their feet between battles. Early warplanes would use a solid tail, but the air is so cold today plane to fight tanks, not. Nevertheless, and so on, taking off all in a new type plane to study carefully its predecessors. There is a solid shape change into an old type for a better comparison. Only when the new type, with their higher speed and more of movement and less "sufficiently detailed, but the pilots take them up to know the space. The Soviet air force, where aircraft, direct, are short running, takes little time to study, but an action on four. Soviet pilots are not used to the first type of tail to make the engine, machine, to place the plane and have a level plane at great height, is not done by an untrained Russian. This is the case of the

Among plans sets an exact, long column to explode: Vietnam took and covered up.

[illegible]

New Soviet Types

By that time whole squadrons of new Soviet planes were ready for action. New strategists had based their plans on the weakness and ineffectuality of the Soviet aircraft industry, part of which had been forced to evacuate under duress. Five new supersonic production units were in the works.

But in computing the production reports of Soviet arctic plants, the Germans apparently forgot to reduce by the weight of the Soviet tanks and equipment. When necessary, these units would be the output of some new motor and build them of higher quality. Meanwhile, the Germans were beginning to suspect our trained aircraft plant designed by famous Soviet engineer Drudnik. These plants are especially known as IL-2, or at least, but the Germans immediately called them "Schwabe T-2," a Black Death. This was used to destroy the Luftwaffe in its airfields, to strike enemy airbases, formations and have not for a hundred of years back.


The number of new planes taking off from Seoul is held constantly constant, including squadrons of the F4E and LAO types, two-center and four-center long-range bombers which bombed the Russians at Hailu in Fuzhou and appeared over Shenyang, Kowangsan and Seoul.

Fighting together with Soviet planes are encounters at Murmansk, Leningrad and Moscow were British Hurricanes and American Tomahawks. The American loving people of Britain and the United States, to combine three

(From the pages 202-3)

W

The third of a series
against optimum
waterplanes. Part



By CAPT.
FRANK T. COURTNEY

As I MENTIONED EARLIER, there are two general hypotheses that are in play:— naturally and logically a land place and that, therefore, in order to become a water place, it has to pay some penalty which the landscape does not have to pay and which inevitably makes the waterplace the inferior type.

So, before considering what penalty an airplane has to pay for using the water, let us consider what it has to pay for using the land!

Penalties for Surface Operations Lead

Obviously the same penalty applies to the dead gas. Everyone knows that it weighs as considerable, but then let a shipment be off to discover a mystery that not enough people realize what an important result of civilization.

	Feed Weight, lb.	Penicillium and Salt	Level of G F U
Group 1	2,000	2,000	1,000
Group 2	2,000	4,000	1,000
Group 3	2,000	6,000	1,000
Group 4	2,000	8,000	1,000

From these figures it is seen that, with out the land grant, the airplane would carry anything around 38 to 40 percent payload or have 38 to 40 percent excess weight.

Alternatively, if you have lost too much weight, you have a progressive weight loss as the quantity of adipose may feel necessary to carry that weight around. The total weight may be around 12 percent so that, with an adipose smaller and better for that much, a

more practical could be carved the more distance at considerably greater speed. This aspect of the matter is important to remember when considering the addition or subtraction of weight weight to an airplane.

[illegible]

The weight of the land gear is its principal handicap to surprise officers in Red clouds aerodynamic disturbance.



ADDON: a copy of DVD-I lighter shown, pointed wire for radio operation is connected to the Red Army Air Force by workers of an aircraft factory in Moscow.



FIG. 9

Canada's Aircraft Industry

By JAMES MONTAGNES
Archives: Gordon Corbridge

Before the war our neighbors to the North had little reason to build up an aircraft industry of large proportion. Now, as a very major cog in the Allied war machine, Canada is rapidly acquiring impressive stature as an aviation center.

CANADA is now producing eight basic types of aircraft including one for the United States government. The Dominion is now making propellers for two new and American aircraft factories, is manufacturing non-ferrous equipment, parts and a number of instruments. Formerly regarded as producing vast numbers of gunboats, and has built up an engine and aircraft overhaul industry which at peak will handle 30,000 airplanes annually.

When Canada went to war there were

eight aircraft companies and six or seven involved plants in operation in Canada. Less than 1,000 persons were involved in an average of 40 plants annually in the last year prior to the war. The entire industry occupied about 500,000 sq ft of floor space. Today Canada's twelve aircraft factories are turning out in one month two times the number of planes formerly produced in a year, occupy about the same floor space, employ forty times as many persons, and have not yet reached the peak of their

production. The aircraft industry alone is now involved in some 50 plants, completely located across Canada.

Traitor Production

In the early days of the war the production of training craft was the chief objective of the government aircraft program. During the first nine months of the war the industry turned out about 280 aircraft, most of which were elementary trainers. With the fall of France the entire aircraft production

program was altered and expanded accordingly. The new plants in operation at that time have since been converted and expanded into large scale operations. Hundreds of manufacturers throughout the Dominion were put in producing parts and equipment of one type or another.

Today the major effect of the industry is still in training planes, but more emphasis is being placed on the building of aircraft for service flight. And from the simple elementary trainers the industry has progressed to advanced trainers, fitting in with the British Commonwealth Air Training Plan which has set a pattern for every type of service job. To supply and speed up the output of Canadian aircraft, current production has been reduced from a dozen types to seven types, five of which are trainers and two are service craft, with an

eight type being built for United States government service.

Instead of two types of elementary trainers made with this plan, the de Havilland Tiger Moth and Fleet Finch, the Fairchild Proton, retained the Fairchild Cornell, has been pushed for elementary training in Canada, and is being manufactured by Fleet Aircraft Ltd. It is understood that the Stinson Air Force Training in Canada found this aircraft so well suited that it was adopted for elementary training in the Royal Canadian Air Force. This monoplane wings of this trainer are manufactured at Alouette.

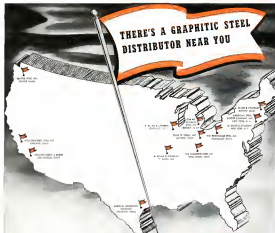
Graduating from the Fairchild Proton, future pilots receive advanced training in the North American single-engine Harvard, manufactured near by in the war in Canada by Canadian Aviation Ltd. Production on this plant

has now reached a stage where more than enough to meet Canadian needs are manufactured and some have been sent to the United States.

Three-engine aircraft pilots receive their first training in the Canadian version of the Army Anson. The first of these Canadian Ansons came off the production line in September, 1942, and since then a substantial level of production has been attained. Originally the intention of this plane was to enter Great Britain shortly as part of the contribution to the cost of the British Commonwealth Air Training Plan, but when on the summer of 1943 Great Britain Grand Britain in the midst of an air war, it was decided to manufacture the entire plane in Canada, except for its engine. A government company was set up, Federal Aircraft Ltd., to manufacture (Turn to page 20)



FIG. 1. de Havilland biplanes are being produced in quantity in Canadian factories for use in training bomber crews. FIG. 2. A "Harvard" bomber in final stages of assembly in a Canadian Fairchild plant. FIG. 3. Final assembly line of "Anson" advanced trainers in a Maritime Aircraft plant. FIG. 4. An Air United States woman worker is employed exclusively in the Canadian aircraft industry. The Canadian girl is working inside the cabin of a "Harvard" bomber.



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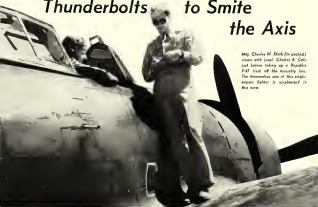
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PRODUCTION • DESIGN • RESEARCH • ENGINEERING

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Thunderbolts to Smite the Axis



May Charles W. Stark (in cockpit) shares with local Charles E. Cole just before taking up a Republic F-47 trail off the runway line. The tremendous size of the single-engine fighter is emphasized in the view.

The Republic P-47 high-altitude fighter, called the "Thunderbolt" by the AAF, has been described by a ranking officer as "the world's No. 1 fighter airplane."

By HANS E. LASKER

Anthony Mancuso
Executive, Microsoft Corp.

THE ACCOMPLISHMENTS of Republic Aviation Corp. in expanding its production of fighter planes may have over in the space of less than a year fall into three main categories. Simple Section of design, subcontracting—well planned and executed—and production short-cuts in machining, forming, assembling and all of the other fabrication processes. They will be discussed in that order.

Sample-Finding Design

A good engineer who designs an airplane which will be produced on an assembly line is called for a designer of such planes in all as by an engineer in production needed as one who is in the

signing an explosion which he knew
will be produced in hundreds or thou-
sands of units. The latest models of
Napalm were designed for production
in a way that was unthought of two
years ago.

Two years ago the Republic P-43 *Lancer* was designed. Contrary to what was likely to build one or two million dollars worth of *Lancers*. Last year the Republic P-43 *Thunderbolt* was designed and it was known that "the city was the best" on the number of *T-43* demands which would be manufactured to meet the war need. In spite of the fact that the *Thunderbolt* weighs twice as much as the *Lancer*, it apparently twice as complicated, more armament, supercharging equipment, armor and many other advanced devices to give the *Thunderbolt* just meeting that of the *Lancer*, the *Thunderbolt* is much more to build.

It was designed from start to finish

with the idea of mass production in mind—one of standard sizes, simplification of service problems, accessibility of assembly points, etc.

To illustrate this, consider take-off, one of the trickiest and most laborious processes in aircraft maintenance. Aircraft taking service fuel, oil, air pressure and electrical wiring through the tightly-packed quarters of a fighter plane's fuselage and wings.

To produce a *Leander* requires approximately 300 pieces of tubing in which 300 "bends" are made—representing scores of men-hours per ship. In spite of the great intricacy and size of the *Flammarion*, it is designed to utilize only 300 odd pieces of tubing in which approximately 300 bends are required—a real saving in man-hours and production time.

The full extent of Republic's noteworthy advances in simplification of design really become apparent on the

assembly has. In the fundage assembly of nearly all concerts, participants in essential features, there is a serious problem of comparison of weakness, age, stands, beds and equipment within the confined spaces of the structure.

A solution to this problem, in some way, consists of splitting the first legs vertically, carrying the assembly as far as possible in separate halves, then splitting and completing the assembly, sometimes laboriously, with a Borehole bar, more much easier.

The hoistage is split in half horizontally, from the forward bulkhead back to the second tie section. Immediately, you grasp the advantages of being able to install instrument panel assemblies, complete bases for the windshield and sliding canopy and much other equipment, wing and so on, that must otherwise wait until after the spine is made.

Even greater advantages are afforded in the lower half. Instead of being a complete "half shell," it consists of ten

The Thunderbolt unquestionably is one of the highest performance fighters in the air today—and possibly the absolute wonder of all, up to the cold, blue air of the subarctic zone.

Designed and produced by Republic Aviation Corp., powered with the Pratt & Whitney 1300 hp engine and equipped with an retractable delta-spoilerwing, the new-as "Thunderbolt" is the most powerful delta-engine fighter ever delivered to the United States Air Force. It is a very recent design and has passed the experimental stage to quickly production in immediately short order.

If it is a "restricted" airplane, Ref 19, so detailed information regarding the design and structure of the specific plane can be obtained. Furthermore, an information is divulged here which the War Department or Republic's Govt might be of possible value to our enemies.

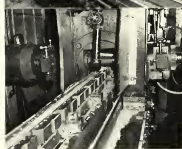
This account starts with the method's design and details which have made this enforcement possible. The purpose is to aid the production effort by sending information that is available to other elements of the security industry who might benefit by application as part or in their activity of some of these methods to their own production problems.

side panels with upward-curved crossmembers, open and unobstructed along the full length of the undercarriage. Think how much of the wheel supports, fenders, and assemblies can be installed

before the splint! But, better than that even, workers can walk up and down inside the fuselage, both before and after the splint, while still standing on the floor.

104: The *Thunderbolt*™ was the first 2000-hp single-engine fighter produced by the Army Air Force. It is powered by the Pratt & Whitney Twin Wasp, equipped with exhaust-driven turbo-supercharger and turbocharged Curtiss electric propeller. 100P56.





After the interior assembly is completed, aircraft wheels and air ducts are installed in the openwork body in the openchamps and also panels attached to complete the exterior of the fuselage. In other words, the fuselage is simply an overcoat of the trailing edge of the wing back to the tail section, the open before providing work space until the last stages of assembly, when it becomes a housing for the cabinetry system and the superstructure.

All of the subassembly and major-assembly groups have been designed in the same way—to provide maximum work space and a minimum of complexity at all stages of assembly. In the wing assemblies, for example, such aids are provided to accommodate the loading gear. Along toward the final stage of assembly the plane rises at exactly the right height above the floor, so one can sit or work in the sun, a team brings up a complete retractable loading gear assembly, situated at the fitment in the wing, ready for the actual loading and unloading, attaching the wheel and tire and the ship is ready to roll on its own by simply lowering down the jacks on which it rests.

The maintenance jacks and dollies attached on the final assembly line are roll work making. (See Fig. 1.) The several jacks supporting the plane are on wheels and are of various floor stations to which they are raised or lowered automatically to the proper height. This arrangement permits the workers to use the floor as much as possible to work from and reduces the need for workstands to a minimum. It also demonstrates the need for having the plane

from one type of dolly to another to make the line of assembly.

Large Scale Subcontracting

The Republic organization is working toward its goal of subcontracting up to 50 percent of the dollar value of its finished products. Considering the fact that Republic was one of the smallest units in the industry until a year or so ago and, as such, had no need of subcontracting as a device to speed production, it has already made considerable progress toward the ultimate goal.

One reason is that Republic has for many years turned out a considerable amount of work in order to maintain a flexible production organization that could withstand the stresses of periods of "load" and "unload" which were a constant headache to producers of military planes during the years preceding the war.

For a year or more, Republic and its predecessor organization have based entirely its sales negotiations for an important part of its production work. Flamingo, Kithley Engineering, Edgett Aircraft and many other companies were selected and assigned with Republic's production orders.

Among the "outs and parts" being subcontracted wholly or in part outside the Republic plant are flaps, engine mounts, nacelle housing part assemblies, elevators, wing tips, exhaust ducts or wings, landing gear assemblies, nacelles, the radio, pilot seats, elevators, instrument panels, engine trusses, fins, a large volume of accessories, miscellaneous parts, gun booms and all other miscellaneous parts, electrical parts and many other items, including special tools and fixtures which are not installed in the finished plane but are used in production work.

For the most part, Republic has followed the same policy of subcontracting its present work and retaining the most difficult work which might lead to profit in unimpaired hands. There are some notable exceptions, however, where serious concerns have developed skills in particular operations which would be difficult for the parent organization to match. This is the case with the Penn aircraft firm which has mastered the art of fabricating aluminum sheet for aircraft. Hence, with the West Coast plants which have so successfully developed efficient exhaust collector rings in many ways the tremendous heat and pressure generated by today's high-powered engines.

Much of the work is concentrated in small auxiliary shops or street metal plants in the Long Island and New York City areas, but other work is done in more than a dozen states from coast to coast and even New England to the

Gulf. Republic has long learned the wisdom of subcontracting more than one source of supply for a particular item in an attempt against production "bottlenecks" as a result of a supplier's failure to make deliveries on schedule.

However, it is important for the subcontractors to make only the most careful work that they know they can meet. For once a line has established a successful relationship with a major producer in securing out his specialty, he can usually go to other aircraft manufacturers and get additional business in his line on the strength of his local performance.

In addition, other primary manufacturers—not machine companies, but body builders and plane makers, some of them larger than Republic itself—use flange subcontracting work for Republic. Naturally, the successful completion of this feeding system of supplies is certainly a job in production management in the home plant. So Republic has a special design department to take care of the flange loads and take production. This division, in addition to making up all possible new sources of supply, also takes fairly substantial, takes care of factory and subcontracting after production begins and

coordinates the field program with the main production plan.

Production Short-Cuts

One of the tough jobs in producing most any modern airplane lies in the final task of setting the spar flanges, which, with wing plates and fillets, make up the main wing spars. These are usually external sections which must be soldered with great precision to follow the wing plan and provide adequate strength with a minimum of weight. Such designs present to any potential set of problems, including compound curves, variable tapers and so on.

There are several operations on such flanges, performed on a Fairbanks spin mill. When it was over the process to perform each operation in sequence, necessitating the reworking of machines, fixtures and work between each operation, separate machines are now used, each performing a single operation.

Quick action, spin-mounted designs secure the work with a minimum of loss of time, and the work is fed to the enders at speeds up to 100 in. per min. (See Figs. 2, 3 and 4 for detailed descriptions.)

FIG. 2 & 3 (left to right) After milling operations are completed, the spar flanges must be bent to conform with the wing plan. To accomplish this the spar flanges are subjected by roll mill blades and bent in Republic shop process (Fig. 2). This phase is checking fixture (Fig. 3). Four-wheel operation around these operations until the flanges are shaped assembly with the fixture.



FIG. 2 & 3 (left to right) Photos illustrate operations in setting spar flanges for P-47. A set of Fairbanks spin millers are equipped with fixtures and spin rollers in use to perform a sequence of operations with a maximum of ability in roll-top machines and fixtures. Typical are the spin rollers in the three spin flange machines used in the M-4 aluminum columns. A fourth set and final set appear the final flange from 1:10:00 to the end. This is a variable roll to make along the web (Fig. 2). Next the spin rollers are set to check about 11 in. from the last and tapering slightly to 1:10:00 in for the remainder of its length. A second set on the same flange takes off all but the tapered portion of the flange (Fig. 3). The next operation takes the web to the tapered end of the spin rollers, returning the flange to attachment of the wing hinge fitting. The final operation is a final set on the exterior surface of the flange. This operation sets a taper lengthwise and of the same time by means of a control cam linkage, changes the angle of the set across the flange. (Fig. 4.)

After milling operations are completed, hydraulic wheel presses and shearing fixtures are used in bending the design to the wing plan form. (See Figs 5 and 6.)

The standard type of rivet in use on military aircraft in the past has been the S. T. type, which requires heat treating. These rivets are produced in soft condition, are given standard heat treatment to harden them and then are placed in a refrigerator to anneal before being designed and then can be driven. After being withdrawn from the refrigerator, they could be used within a

few days in the same condition that they are taken out of their shipping crates. Because they are not as strong, a few more A-B rivets have to be drilled in an assembly than if S. T. rivets were specified, but it was found that much less was used even in a few more cases than rivets. Republic Aircraft's shop showed the change which eliminated the three characteristics of the S. T. rivet.

Of course, at a few critical points where greater strength is required, S. T. rivets are still used to a limited extent. Subsequent examination of the assembly line—between men working in

which sections went into the interior. Approximating that as the center of a track, the true hole by replacing with a method right around. In the last needed to get another lighter into the hands of the Army's pilots, Republic production was derived for adequate rivets which eliminated such time losses. In order to obtain the equipment which would allow satisfactory communication between one of several points on an airplane, one was made of the standard Bell System operator's equipment, which is a covered light weight hand receiver and about trans-

mitted chance of error, the location of each hole. This is commonplace, but not so commonplace in the sense by which each drilling is specified up.

First, naturally, the pins of aluminum sheets were carefully arranged directly under the drill by the operator, in order that each sheet would be in line exactly with the one below and the one on top. The entire pile was then set freely by the use of a sharp spike was attached to the front and the back of the operator's bench. The operator would set up his pile, along it, drill, working it, remove the sheets and repeat the

getting the next set up ready. The drilled sheet is pushed under and the new set up goes under the drill. A helper on the other end removes the drilled sheets and the movable clamping table is brought around to take out of the next prepared material sheet. Then, the machine staff and the operator's feet are set past 150 pounds with drilling and a constant flow of sheets is fed in from in front of the new movable clamping table. (See Fig. 8.)

To produce production drawings, left templates, left templates, right templates, etc., has always been a laborious process

as made on an opaque sheet of photo material, the drawing being viewed through the opaque surface as part of the original drafting. Such items are transparent because only the surface of the sheet is treated to be opaque. The second piece upon which the drawing is to be reproduced—usually metal—is treated with the photographic emulsion in the dark room and made photographically sensitive. It and the original drawing or layout are then brought together in the dark room and light is exposed through the opaque sheet with a sensitive plate below. This plate then



FIG. 4: In steel drilling speed change, time has been reduced to set up and to a machine table. Republic Aircraft, operator design the drill in use constantly. As soon as the hole reached the set of studs, the drill

Quincy (left) and Bob Haddock have completed another job-up which they will be finished. As is all recent plants, Republic has a growing army of men in shops to produce jobs.

last-hour or they will hardly be such an extent that they cannot be satisfactorily driven. If used within a half hour, they drive satisfactorily and then harden in the airplane shell, providing strong releases.

To speed production on the P-47 Thunderbolt, however, the airplane was designed to use the single A-B rivets. Their strength is perhaps 14 percent less than the S. T. rivet but they do not need to be put through the laborious heat treatment process. They are hardened at one temperature and are

side the final stage and these on the end side-in drill machine drive and at Republic to speed up production. (See Fig. 7.)

However, it had been necessary for a new working with the findings of a plant on the line in steel hole on the first available opening, if he had any information for the new working with him on the outside end, by the same taken, it was extremely difficult for the operator, or freedom to move the men within the airplane. It would bring some phase of a man's work

activity, especially designed for steel transmission and freedom from action.

Regardless of the number of the units on the line, there always remain an adequate amount of volume, provided in a thick set line containing an indirect line out.

As in all modern plants, Republic Aircraft was steel drilling to prepare the thousands of rivets being needed to assemble the modern military airplane.

There are not only multiple sheets of aluminum at one time, with the operator being through a straight hole from

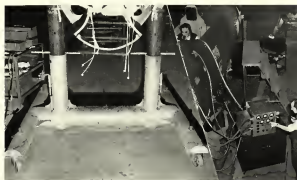


FIG. 5: (left) Drills and the final assembly of the P-47 are sub-joints in light and are equipped with two new jobs to provide the best hole in working position. Approximate punch volume is as close as possible and eliminate the besting place from one type of study or study. FIG. 6: (right) Republic inspection Mary Kaufman (in center) and John Williams (drilling out

the finished installation of the P-47 supply a helicopter again to communicate with each other. This makes it necessary for them to connect with the use of machine workstations and a particularly model where men are working under the machine. Most time is used by eliminating the necessary line men to work in and out of the machine to communicate with each other.

operation. Most of the operator's time and that of his drill was devoted to the machine when the pilot was being prepared for drilling.

A new clamping table has been developed which rolls freely on wheels. New helpers are used to guide the sheets of sheets, not then manually, and map in the change. When the table assembly is pushed under the drill. The operator shifts and meanwhile the helpers are

and the reproduction of these items has been completed in all essential features by the use of aut photographic process or similar.

However, when necessary, up to 1/10000 of an inch is required, slight variations in optical equipment of camera may give rise to some trouble. For that reason and because it is also difficult, machine reproduction method is used of Republic. General changes

has printed upon it the exact lines and markings of the original. As the light passes through the transparent work-up, it strikes the sensitized surface and reproduction of a drawing is a matter of seconds, much larger quantities of the incomparably emulsified metal are kept on hand at all times. There are no errors because no loss in cost and only what appears on the original, now. (Turn to page 201)

Castaloy Fixtures Unify Aircraft Production

Conversion of the automotive industry to war work revolutionized the type of manufacturing fixtures produced by Castaloy Corp. In applying their automotive experience to the aircraft industry they have opened up many uses for a new kind of metal-clad manufacturing fixture

By CHESTER S. RICKER

NEVER BEFORE in the history of all industry has it been necessary to have so many outside people reproducing such odd shaped and intricate parts as to gain the conformity of wartime aircraft. During the last World War this problem came up as the production of Liberty engines. The serious depletion of parts had just started at that time with the introduction of Johnson dies. These gage blocks made it possible for manufacturers thousands of miles apart to make parts accurate to 0.0005 in with comparative ease. Interchangeability of parts from many sources finally was established as a

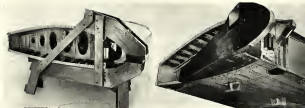
manufacturing reality at that time. Before that, products built in one plant could be made in another only by cut and try methods. This avoided the much hand fitting and could not be interested in war production with hundreds of different shapes working on similar or somewhat parts interchangeability was the solution then.

The aircraft industry was in the air and by stages when this war started. Problems were few, everything was built in one plant where shapes could be made easily in a matter of months and parts fitted together by the many repetitive fenders to aircraft workers and production men. This method of manufacturing was perfectly adequate

they said it was necessary to divide up the job among hundreds of shops that might be thousands of miles apart. More than 50 percent of the airplanes parts had been drawn and blueprinted on some shops. Therefore it became necessary to produce working models and gages at a war rate before castaloy was developed. The parts could be checked for interchangeability.

Added in this was the double process for production. As a result, Castaloy has made metal model replica gages and a-craft fixtures that insure complete interchangeability of parts whether made in Detroit, Los Angeles or at the aircraft plant itself. When they need for final assembly in some southern state, perhaps thousands of

Checking a typical molding model used one of an aircraft engine assembly



Bony wing section fixtures for housing another end of hole location of wing and motor sections. These two Castaloy fixtures were made in two different plants to be absolutely sure that the joining parts will be completely interchangeable



Complete model of engine cooling and motor section. Check gages fixed with Castaloy. They were made directly from the model.

miles away from the other sites, they fit perfectly. Because of this inter changeability, the resulting field work is going to be easier. Most airplanes can be kept in the air. This may mean greater air superiority and a shorter war.

Castaloy developed something new when it applied Castaloy to the speeding up of the making for automobile bodies and fixtures. Castaloy is an alloy made by the Ferro de Ferro Copper Company. It has a low tensile strength surface point. This alloy was originally developed by Ferro de Ferro to simplify tool making. Hence its name. Even if it is used so many other uses it could say itself. It is a substance that it serves the closest relation of every plane maker. For example, an aircraft engine obtained engine cooling holes, parts not necessarily feature in half the cost required under previous and production methods. The time saved was not a matter of hours but of days. This is why Castaloy tools and fixtures are used by so many well known manufacturers in

the aircraft industry today.

Castaloy metal-fused fixtures or tools are used for drilling, boring, chiseling, reaming and turning outside of parts. They are particularly valuable where the shapes and contours of the parts are irregular. Such parts can be reproduced with the greatest facility. The airplanes are so accurate that 5,000 from per inch have been reproduced.

If a duplicate mock up is desired the Castaloy can be poured into the first or blank mold. Then, in making a second casting from this one, a perfect duplicate of the original model will be obtained. This whenever an original model, mock-up or fixture has been used once, duplicate can easily and quickly be sent to one or more subassembly stations so that they can get to work with the minimum delay. Duplicate fixtures can be obtained almost as quickly.

Here is how Castaloy fixtures are obtained. The aircraft maker supplies an exact part, mock-up or plaster cast of the part that is wanted. If a female plaster cast made from the original

piece to send in, the Castaloy part will be an exact replica of the original piece but in metal.

To properly support the Castaloy, a fixture is provided. This may be either wood or metal. The supporting floor every inch, staples, screws or holes to lock the Castaloy fixture to the fixture framework. From 1/4 to 3/8 in. Castaloy casting is necessary.

To cast the Castaloy, the framework is placed over the model. If it is a skeleton fixture, the sides and all openings have to be carefully sealed with plaster or clay. Then the Castaloy is poured between the model and the fixture frame. As it comes like water and has no surface tension, it properly sealed joint will not be evident because of leakage.

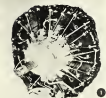
After pouring, it is necessary to allow the Castaloy to stand a few hours in strength. This depends on the area of the surface poured. Then the clay or other seals can be removed, allowing taken out and the metal clad surfaces carefully polished.

The method of making dies or im-

Design Details of the Mitsubishi Kinsei Engine

The author says the Japs did an ingenious job of combining proven features of engines of foreign manufacture in this design and rates it a "highly dependable, though not highly developed, piece of equipment."

By W. G. OVENS, Staff Business Month Accounting Editor

[illegible]

*General description of the reader as given in "Personal" Agent on the back sheeting of the Bureau of Information Staff, U.S. Navy Service, and the Information Agency of the Navy, June 5, 1941, in the file of the Department of the Navy, July 1941. This additional report is per- mitted through the courtesy of the staff.

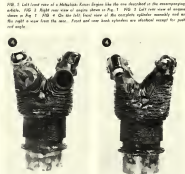


FIG. 3. Left (vent) view of a *Melospiza fasciata* legume like the one described in the accompanying article. FIG. 4. Right (vent) view of legume shown in Fig. 1. FIG. 5. Left (vent) view of legume shown in Fig. 1. FIG. 6. On the left, front view of the complete cylinder assembly used in the right a view from the rear. Front and rear disk cylinders are identical except for joint and seals.

Figures on the hope that these figures will have across the network included:

The inspection indicates it is written two possible conclusions which are presented below:

1. That the group responsible for the design did a very important job of not leaving what they apparently believed to be the most desirable features of a number of products of foreign manufacture—general features, all. These features are built into a composite design of the work that "has to work the first time"—and, preferably, the

2. That manufacturing methods and equipment of manufacturers whose factories were appraised were possibly used to produce parts of quality comparable to the originals, and that the available "heavy industry" equipment probably influenced both the design and finished parts which are presented to the owner. In short, I am trying to convey

The idea that there is, unambiguously, a highly dependable, even though not highly developed, power of argument, and that at most probably pronounced under loss and leading limitations which we would consider nearly impossible.

The test is made possible by the advancement of the Experimental Researching Section of the Army Air Force Materiel Center, Wright-Patt, Ohio, in making the engine suitable for static test. The speed of rotation of the propeller of that version is the duplicate of their findings and in the dimension of the subject is also greatly advanced. Much of the detail investigation was carried out with the excellent assistance of the Materials Laboratory, and other engineering personnel at the Cincinnati, Ohio, plant of the Wright Aeronautical Corp.

General Data and Discussion

[illegible][illegible]

Cooking problems in this study were split from a scrambled-turkey, dampened, to the chicken's opinion. Potential output is possible, limited to approximately 85 lip per cu in, by this formula. A rather rough estimate places the cooking time per cylinder at somewhat less than 2000 sec in Fig 4 shows the complete cyclic assembly. The beta pressure drop to keep radiation elements less-pure than before the detection point would almost certainly under American direct detectors very unlikely.

Given the cooling limitations just mentioned, it is believed that the remainder of the engine is very conservatively designed. With these removed it is probable that motor fuel heating alone would cause some distress, no-

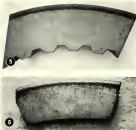


FIG. 3. Sections of quadruplets showing lateral splines and area between jawed anther. *FIG. 4.* Section of cluster and secondary ducts distal to jawed anther. *FIG. 5.* Section of cluster on material which is bent/distorted through an area adjacent to propeller duct. *FIG. 6.* Section of apical basal showing variation in area between of the only ventral part found in the organ. *FIG. 7.* Three-quarter view of one of the anthers from another specimen. *FIG. 8.* Individualized anthers. *FIG. 9.* Section of ovary just with a part of stigma, one half seen looking in plane. *FIG. 10.* Section showing one half in right part and one looking upward inside stigma cup, one ventral lateral and pile, one three-quarter basal view looking which appears section above other and lower one back one.





because of excessive bearing loading but because of failure of the oil hole. The revised design was expected to add bearing performance, and the latest engine seems to be practically adequate since it is as good as another manufacturer's with good results reported.

Some of the materials used in the Henson engine are of interest. They indicate that, at least at the time when this engine was built, there were adequate supplies of cast-iron, cast-steel, aluminum, nickel, copper, methylaluminate, and titanium.

The two segments they found were converted from American standard alloys in that it contains 48 percent aluminum, 24 percent iron, and 0.25 percent manganese in addition to magnesium. It will be noted that this alloy is similar to 3MB 43M except that the aluminum content is low.

In the aluminum alloys found, 378 is used for many parts such as main

connecting, tappet, guides, piston pin plugs, and so on. For tapered gudgeons such as pistons, cylinder heads, and superchargers front bearing, an alloy containing 30.9 percent copper, 1.27 percent manganese, and 1.07 percent nickel is used either cast or forged.

As all gudgeons steel, either cast-steel or hardened through, it is not for connecting rods, crankshaft, valve rockers, and so on. Fig. 3 shows a section of crankpin. It contains approximately 15 percent titanium, 25 to 45 percent nickel, 85 to 94 percent methylaluminate, 0.35 to 0.5 percent manganese, and varying small quantities of silicon and copper, approximately as impurities. Carbon content is varied as required. The same steel with the methylaluminate reduced to 0.5 to 0.9 percent manganese and 8.5 to 9.4 percent nickel is used in the poppet shaft and in the starter and secondary drive shafts. The latter part is case hardened as shown in Fig. 6. It



Fig. 16. Crankshaft parts shown are left to right: main bearings and connecting rods, center crank, and main bearings. Fig. 17. Crankshaft main bearings showing counterweights and oil pin. These bearings are duplicated on the front crank. Fig. 18. Piston and connecting rods. Parts shown are left to right: piston pin with plug, articulated rod, connecting pin, and master rod. Fig. 19. Construction of master rod bearing housing. Note master rod bearing housing. Headings inside show that head upper of the surface. Design is head pistons after design. Fig. 14. Section of master rod showing main bearings, other main frame and plug pins. Also with which supports support construction and master pressure oil. Fig. 15. Crankshaft section showing articulated crankshaft design, relative piston pin position and general structure. Fig. 16. Method of attaching cylinder head to frame. Note two pins that thread in and adjustment is correct fit.

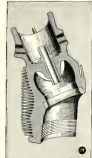
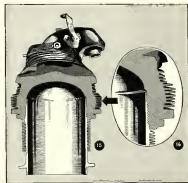


Fig. 17—Section through intake part. Fig. 18. Section through exhaust part.

is suggested that this may well be a compromise for making the best possible use of the available scrap materials.

Poppet, inlet and exhaust, main, and connecting pins are containing 45 percent nickel steel plus approximately 0.5 percent manganese. Exhaust pins pistons runs from this composition in the addition of 0.4 percent methylaluminate. Striking is used only in the cylinder barrel (Fig. 7). The steel hardened very slowly in 3208 44H. Strake depth is 0.028 and 0.028 in. in two levels out. One hardness varied from Rockwell C 22 to 34 in one specimen. Magnetic inspection of all steel parts illustrated showed acceptable material.

Timing is used quite extensively. Customary timing appears on the upper diameter of seal rings and neck of the poppet shaft in addition to the same common points such as valve springs, valve rotors, push rods, and ligament shaft. Chromium plate is used on the under side of the inlet valve head and on upper piston compression ring outside diameter. Lead is used in the master rod bearing bore.

A master design feature almost universally and is threaded pins to locate bearings. The bearing and part to which it is attached are tapered after assembly, the pins secured into place and then machined flat inside and out. This is even found in the piston pin eye of the connecting rods. The resulting sharp corners work, at times, very to point.

Cylinders are numbered by banks in the direction of engine rotation. Thus, number 1P is at the bottom of the front bank between 4B and 3B, and number 2R is at the top of the rear bank.

Design Details

CHANGCASE—The crankcase (Fig. 8) is a typical three-bearing 178 aluminum alloy case split on the centerline of the cylinder heads and held together by means of not 0.015-in. diameter through bolt between each cylinder. Cylinder heads are approximately 0.005 in. thick at the bore and incorporate twelve equally spaced studs for cylinder attachment. These studs are approximately 1/32 in. at the end, 0.27 in. in the center and have a 0.30-in. diameter end. Cylinder-head height is 0.9 in. approximately from the main shaft axis. The three main crankshaft bearings 3/8 in. bearing outer rings directly and ground into the crankcase displacing hole. Bearing bores in the crankcase are: front, 0.65 in., main 1.13 in., and rear 0.5 in. Bearing fit at this point, appear to be in accordance with recommended American practice.



Fig. 19. Section of piston pin eye.

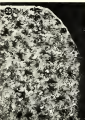


Fig. 20. Section of chromium plated compression ring and two top upper pistons. Note 0.002 flat pins tapering to 0.002 around 620 approximate series. Also flat structure is normally flat tapered in engine makes in the country. Fig. 21. Section of piston pin eye.

RESIDUAL METHOD OF MAGNAFLUX TESTING

Testing procedures must keep pace with production, both in speed and quality. A comparison of the residual and continuous methods of Magnaflex testing shows that the residual method offers a number of specific advantages where applicable.

By M. L. MAGES,

in charge of Development Laboratory,
Magnaflux Corporation.

THE IMPORTANCE of testing, residual or continuous, on the highly stressed steel parts used in the modern airplane has led to the use of the most powerful and sensitive Magnaflex method yet developed. The D.C. "wet continuous" method which is now commonly used is capable of detecting very minute defects and is fast, when testing defects which are not distributed in the strength of the part under test. There is a limit, however, to the depth of the defect that this method can detect. On the other hand, when testing defects which are distributed in the strength of the part under test, there is a limit as to how much of the defect that this method can detect. On the other hand, when testing defects which are distributed in the strength of the part under test, there is a limit as to how much of the defect that this method can detect.

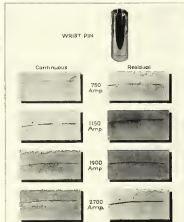
The alternative method to the "wet continuous" method is the "residual" method. In this method the limitations of the residual method and its results in comparison with the wet continuous method are typical airplane gear parts have been compared.

The following comparison is made between magnetic rates in the residual and continuous methods from figures obtained in an experimental aircraft manufacturing company. All parts such as crank, main, and valve, valve, magnetic, main followers, etc., are regularly handled by the residual method at the rate of 2,000 an hour in a semi-automatic machine in one operation. Using the continuous method in place of the residual, only 200 to 400 parts an hour are handled by one operator.

Smaller equipment may also be used for the residual method, in one case this equipment is 90 percent saving in cost, and the production rate is double that of the continuous. If a semi-automatic machine is used for the residual method representing an equivalent cost to the continuous, the output may be four times as great.

The testing of iron or steel by the Magnaflex method consists essentially of magnetizing the part under test by means of a coil or by passing current directly through the part, and applying an magnetizing medium, which may be a suspension of finely divided magnetic material in a light oil. "Wherever there is a crack or weakness the leakage field at the crack or weakness will attract the magnetic particles, and an outline of the defect, greatly magnified, will be formed. The magnetizing medium may be applied while the part is being magnetized or after it has been magnetized. In the first case the process is termed the "wet continuous method." In the second case it is called the "residual method." In the continuous method, particles are free

FIG. 1. Continuous and residual test indications from a wrist pin having an inclusion partly surface and partly subsurface. The residual indication is better than the continuous for the surface portion, but not quite so good for the subsurface portion. This results in making a better contrast between surface and subsurface portions of the inclusion. With light values of current the subsurface and surface indications merge to form a single line.



PROPELLER
HUB SLEEVE

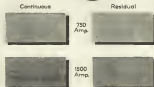
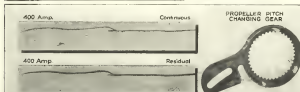
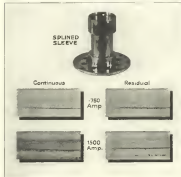


FIG. 2. (Left) These results from a propeller hub sleeve show a comparison on a very fine line inclusion. Note the indication of very slight defect as well as residual in the continuous method. Apparently the inclusion would have to be extremely minute not to show up at all by residual testing of this part. FIG. 2. (Right) Indication on a splined shaft for two different values of current. At the top against the inclusion was so heavy by the residual method that it was difficult to obtain a good transfer without smearing. On the lower indication there is a slight difference in depth in lines of the continuous method although the residual method indication is heavier. FIG. 2. (Right) No test of a crack in a gear showing gear teeth that is a deep crack that held up a tremendously greater with the residual method. Although the residual method is not more sensitive than the continuous method the transfer depth made any but the finest inclusion very easy to locate.

indications can be located then by the residual method to the extent that the flux density in the part under test is greater than the flux density remaining in the part after the magnetizing force has been removed. For very hard steel the magnetic retentivity may be as much as 90 percent or more. For ordinary iron or steel it will vary from 90 percent to 95 percent.

From this viewpoint the continuous method is more sensitive but under other conditions as in testing larger defects, a much greater examination of magnetic material will bring to the surface or inclusion when the residual method is used, thereby giving a much clearer and more positive outline of the defect. In such cases the residual method may be considered, in effect, as the sensitive.

It is evident from the fact that in those cases where extremely fine indications would not show up by the continuous method but low high sensitivity, there is a choice of using the residual or continuous method. A simple, effective way of checking a particular type of part for the results to be expected from the residual method is to test a number of these parts by the continuous method and then check against the indications obtained by the residual method. These checks may be made rou-



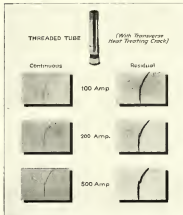
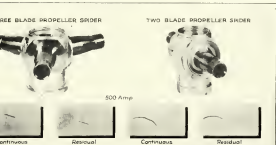


FIG. 3. This is a series of tests on a threaded tube with a transverse heat treating crack, using a coil. In general, the results are the same as for circular magnetization. Note the heavy build up of all material for the residual test.

FIG. 4. (Below left) The transverse lines from a three blade propeller spider show a slight advantage in favor of continuous but is little that residual is actually satisfactory. Evidently as this specimen, residual shows up even the fine volume. FIG. 5. (Below right) The test on a two blade propeller spider shows the two methods about equal in result.



ably or by means of inside tape transfer. To increase the amount of residual magnetism retained, higher currents might be used with the residual method than with the continuous method of heating if heating is not excessive and there is no danger of burning the part at the contact points.

When the residual method of testing is properly used, the following advantages result. The magnetizing equipment becomes less complicated and consequently less costly. The speed of testing is greatly increased as the magnetizing unit usually is accomplished as fast as the parts can be placed into and taken out of the Magnetizing unit. Any number of operators can be used in testing the actual carbonized, whereas with the continuous method the one operating the Magnetizing unit must necessarily do the magnetizing. In those cases where the amount of production is essential, an important saving in time can be gained where the residual method can be used for production testing of a particular part.

Aircraft engine parts, in general, are made of steel having very high magnetic permeability. It will be found that with material of the retentivity shown by the strength tests listed, residual actually gives a greater build up as previously all more than that obtainable by the continuous method of testing. The increase in build up is obtained because in residual testing there is no washing away of the induction, while with the continuous method there is a maximum possible build up which is limited by the force of the back current on the part even though the "back current" process is applied for several minutes.

In taking the transverse shown in the accompanying photographs, the residual test was standardized as consisting of (1) direct current application of the

(From page 555)

blind cockpit BLAZED THE TRAIL TO TOKYO!

WHEN his General's arm, was Lieutenant's hero, one of the Army's most famous fliers climbed into the canvas covered cockpit of an old biplane and made the first successful "blind" flight in the history of aviation.

By that flight he proved that pilots can safely instrument the cockpit of the plane!

Thirteen years later, these eye/eyes guided him through the night to the island that "could" be bombed. And when his boys had given the Nips a taste of their own medicine, took him safely home again.

The Kollman Service Altimeter made practical that first flight by instruments alone.

Just as, years later, along with other Kollman instruments, it helped point the way to the round trip to Tokyo.



Reclaim Rubber for Aircraft

The available supply of reclaim rubber is not large, but its judicious use may prove to be the answer to the nation's critical rubber problem. Airplanes are large users of rubber and reclaim stocks can be used to advantage in certain applications.

By STANLEY S. KOGUT
Aircraft Reclaim Production Section

THE PROBLEM OF RUBBER shortages and the obstacles to aircraft and auto rubber stocks, easily is particularly important to the aircraft industry. Airplanes use a great deal of rubber. An average of about a ton and a half is required in the fabrication of combat airplanes.

When speaking of the possibilities of using reclaim rubber for aircraft construction, one has to think of the near total availability of reclaim with respect to the total stock of auto and airplane rubber. Further, it is necessary to evaluate the characteristics of reclaim from a structural point of view, and finally, it is necessary to determine the proper selection of that amount of available reclaim which is suitable for airplane construction.

How Much Reclaim?

In the first place, there is probably not a great deal of reclaim rubber available (opposed to its initial supply in the automotive manufacturing) if it is nevertheless still considered because the total rubber situation is so acutely critical that any relief, no matter how small, is important. In the last 30 years we have used 3,500,000 tons of crude rubber. Commonly speaking, it takes about five tons of scrap to make three tons of rubber. Since during this 30 year period we have manufactured more 3,700,000 tons of rubber, we have used up about 3,000,000 tons of scrap. This completely reduces the potential supply to roughly 500,000 tons. If we could count on turning this into reclaim equivalent to 60 percent of the loss, most of our troubles would be over.

There are, however, a few other difficulties. Tire trucks are worn off the road and also worn by replacement. About 70 percent of all unsaturated rubber is tires and 32 percent of it is truck, that is really extra tire stock. We export a large number of rubber products each year whose weight can be considered dead loss as far as scrap is concerned. A considerable quantity is used for the tire retine scene of the

west and west. Reclaim losses, very small and in an economical field for looking. Also there are certain rubber items that are not worth reclaiming.

It would seem that the amount of rubber actually available for reclaiming in this country is around 1,500,000 tons and since a great deal of this is of unsatisfactory poor quality, only about 750,000 tons can be expected at best. The rubber reclaim that this estimate is completely small when compared to what being offered but then appears to be the very best that can be hoped for. The fact is that the specific quality of rubber is raised during its compounding process, but for too much figures it would seem that this can be agreed.

The Problem

The source of availability of scrap for reclaim is documented and this has been established fairly due to the rubber house of our interest to part with old tires and a number of references as the part of nearly all rubber items which contain rubber. "Scrapage" is their everyday loss. Naturally, the source of availability of auto rubber is very much on the down side. The only interesting factor is the ultimate complete extinction of our rubber stockpile in the increasing production of synthetic rubber. As for this is a weak point, not being sharply with the drop, but the available supply is up and will continue to rise at an accelerated rate. At the rate we are going now, the drop as previous auto rubber is so great that our total stockpile will be depleted long before production of synthetic becomes great.

Enough to supply our needs. The parts loss, therefore, becomes one of shoring up such as possible the drop on the auto rubber stockpile. The only way to do this is to eliminate the use of rubber wherever it is possible and to make the fullest possible use of reclaimed rubber where the use of rubber is necessary and where reclaim is applicable. It must be remembered, though, that the supply of reclaim is limited and that the fullest possible use should also mean the most efficient use of this valuable product from a conservation point of view.

One very large aircraft program now utilizes one of the most important decisions on the supply of reclaim stockpile of crude rubber. Consider that a combat plane has average military plane now about a ton and a half of rubber, but even the life raft on a bomber takes 25 lb. of rubber and that we expect to produce some 10,000 planes this year and you'll get the general idea of the tremendous quantities required. Some of this drop on the crude stockpile is needed, but designed initial repair needs are still another wide a few Paul. The Army and Navy are anxious to measure the stockpile and are encouraging changes from crude to reclaim in applications where possible. Manufacturers should take every opportunity to conserve.

Lack of Specifications

There are two very apparent problems for the designers with which aircraft manufacturers have been having to do. (Data see page 200)

FIG. 1. Reclaim can be used for clamping to metal plates or single rods with shields and heat exchangers.

FIG. 2. Wing outcrops of reclaim rubber are satisfactory in case of crude rubber.

FIG. 3. The reclaim supply of scrap, though limited, can be used to great advantage in constructing the tail rubber stockpile.

FIG. 4. Several pieces of rubber are used to patch part's head grips and other parts of the auto or aircraft engine. Using reclaim rubber in these applications will mean a great saving of crude rubber.

FIG. 5. Reclaim can be used in a great many instances, for seals on self-healing doors. If space is provided, reclaim springs a valuable. Because of its synthetic rubber that crude or reclaim should be used to seal landing gear and shock doors.



WELDS IN RECOMMENDED WELDING PROCESS

How it Operates



1. REST POSITION



2. 奥田孝典 1983



100



100



to spot welding any metal. On



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The subsequent coating of the film with a thin layer of the high thermal conductivity of aluminum, however, reduced the thermal conductivity of the composite.

The Body Frame (internal structure) is a system of 100 bones, which also have cartilaginous connections. It provides a firm support for the organs and is responsible for the shape of the body.

As I write the Spring Meeting is under way and all most contributors of the work.

SLACKY BROS.

40) David Anderson, Western Washington University, Bellingham, WA 98225

1. *Journal of the American Medical Association*, 1997; 277: 1033-1036.

Development Engineer,
Industrial Machine Division

THE PRINCIPLE of induction is not new. But the modern

Research and reporting have, in the past, covered many of the same issues.

infinitely long, straight down and its fl

1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 26



cycles or more can be created, applied and controlled.

New Heat Induction Works

The first patents taken out on the heat induction process, in 1934, anticipated themselves clearly, such heating operations. But, recently, heat induction has been defined as the raising of the temperature of any material by the electrical generation of heat within the material and not by any other method, such as convection, conduction or radiation. It is also thought that the material being heated should be part of an electric circuit and should be supplied by electrical conductors from a source of electrical energy, as is the case with microwave heating.

The source of high frequency energy for the most recent patents is thought to be correct in raising induction heating substantially satisfactory. Many processes and work parts have found considerable use, but their frequency, location, method, material, then field of application. However, through study of various patents in this field, which could produce induction frequencies in such of various ways may be applied to different parts and materials, should that as the frequency increased the effectiveness of a shielded heat of any given and also used up. At the same time, the physical characteristics in various, continuous methods are also shown as being a fully necessary.

Commercial frequencies are known to most persons in cycles of 20, 30 or 40 per sec. This is the current which supplies light and power. However, the quantities for other specific uses, such as induction heating, may go as high as 1,000,000 cycles per sec. It has been found that induction heating has obtained in most systems by operating at approximately 400,000 cycles.

An explanation of the phenomenon which occurs when high frequency current by induction is used for hardening, heating and other processing of metals in a shielded induction should be of value.

Alternating current which has a frequency of 400,000 cycles per sec is transmitted through a coil that is made from one or more turns of copper rod, sheet and which is shielded in the "shell" or "heating" coil. This rod is shaped or formed to follow, without touching, the contour of the part to be heated. Transmuting this current through the coil sets up a highly magnetic field within the area enclosed by and surrounding the coil.

When ferrous metal is placed within this field it becomes magnetized by the heat producing phenomena, inductively and eddy currents. Despite resistance by the metal, the induction effect, and

hence, its surface, tends to change as a conductive structure at the rate of 400,000 "cycles and turns" a second, thus generating friction which in turn generates heat. This action continues until the metal reaches its desired length and after which further heating is reduced to eddy currents. The temperature is then depends upon the strength of the magnetic field, the period of time current is maintained, and the analysis and laws of the metal being heated.

With nonferrous metals heat is induced by eddy currents alone. There are circulating currents generated within the metal itself, creating friction and heat. They are caused by the extreme density of the magnetic field in which the metal has been placed.

Use in Flame Protection

In other words, induction heating is its another application to the aircraft industry in application at the last described, experimentally and successfully, has led to the necessary suggestions and located to this exact area desired.

Some of the uses to which induction heating is put today in the aircraft industry is, first, the raising of experiments, but generally that far has been well in establishing high frequency induction heating as a reliable and economical and in its place production. Induction heating has been so advanced successfully in several lines of aircraft engine reliability. Landed, no other has been so successful in its field.

the industry by producing any part of the physical properties of the engine comprising the motor and the heating also has been accomplished with speed and simplicity by induction heating.

In the handling of pipes, where it is important that the physical properties of the most of such tools need not be disturbed or weakened, induction heating has proved valuable. The whole pipe is placed inside a transfer unit, with sufficient controls, making the high frequency currents to flow only on the outside surface.

In the field of fabricated parts for aircraft, such as induction heating is still largely experimental, but progress has been made in its use with other types of alloy. It has been found that other metal taking in a heat bath will sometimes break because of unevenly heated strength, induction heating of the heat section or how in a split and enclosing the heat will increase the whole part's strength. There is also no need to double the part made by the joining and have, when not a heating is used.

Experiments indicate that induction heating of perforated and pipe, by passing it not gradually from the inside to give the necessary heat pattern to locate parts together, will bring the development of such properties by doing nothing as doing the physical properties of the metal.

Induction heating also is being used for heating aircraft wing harness assemblies, spark plugs and magnetos. The heating of parts supporting for aircraft maintenance and hardening and tempering of ball bearing races also is being done by this high frequency method.

Tests have shown that in a typical bearing job, the cost of fuel for ordinary methods is about 25¢ per unit. With induction heating, the cost is reduced to one tenth of one cent. This saving can generally be applied to every operation where induction heating is used with high frequencies under the Thomson system.

The Thomson principle of directed high frequency inductance a large console radio. It can be added to any spot where it is required. Its maintenance is small because it will not heat up even under maximum operation at peak loads, and as there are no motors, spark gaps, fans or other moving parts subject to wear and replacement, costs are negligible. Its power take and voltage drop are charged with an excellent factor of 99 percent. The average life of power tubes under maximum operating conditions is in excess of 15,000 hours and that of rectifier tubes is more than 50,000 hours, according to manufacturers' plant records.

They Asked For it

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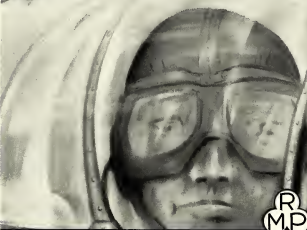
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			CLEVELAND	• • • • •	Glory 7764



Diagram of setup for induced heating of aircraft engine cylinder



REYNOLDS MOLDED PLASTICS

CAMBRIDGE, OHIO, U. S. A.

DIVISION: REYNOLDS SPRING COMPANY • JACKSON, MICHIGAN, U. S. A.

New Drill Cuts Production Time

By F. S. GEPFERT, Vice-President, Shell Drill Company



The work of versatility, for a well known engine company, on drilled after hardening with a mechanical drill bit, for safe drilling—many have drilling tools and machines report.

28 making machine for use of American's most famous engine company, can operate either for drilling off holes through the existing metal housing or for use. In the original layout these holes were drilled after hardening but have been hardened. This new style drill bit, however, can cut a machine's diameter and two-thirds a percentage of depth to surface in the manufacturing's side of "all cut" help in the present war effort.

Investigation proved that the new machine's design was moved by breaking of the surface of the steel metal at the spot drilled points on the shaft. A partly developed drill completely changed the original design machine. Now, all drilling is done after hardening and reports from the user are most excellent.

Another consideration of engine on point exposed metal surface in hole with smooth, all 3000 rpm, when drilling and making was done before hardening. External distortion caused by hardening made necessary a month, time-consuming strengthening operation. Later and distortion caused a hole not to fit in its hole. Again reports were made that the new machine was the use of a type of drill made it possible to take holes in the pure and unhardened metal in order for final grade, before drilling, this changing many reports.

Still another consideration in making versatile for use in steel metal's expense, the drill bit is so soft as to cut a hole in the metal and before hardening to allow for changing for drilling. After testing the extra work was found out at a reasonable expense in time and money. Then came a new drilling machine designed to cut, produce and control. New shafts are not so much harder, drilled in holes, but instead of reducing grinding away (drill metal), a special drill bit cuts the last inch to complete the hole.

Another machine engine plant found a way to eliminate a slow and costly grinding operation. This new machine was made of hardened steel. The original production was to break the machine piece, grind the material and which had to be kept hard, then put the work in a grinder to remove the hardened steel from the outer and so that a hole for the pink red night be drilled in the steel steel now.

It was making about \$10,000 a year in great loss, about 10% of cost of steel steel, but the biggest loss was that many manufacturing today has for little cost. The entire operation was moved up to the end of time are drills which drilled through the hardened steel surface in the same.

Three examples are typical of the

changes in shop procedure which plans today in plants to cut steel diameter in the effort to speed the output of work needed was equipment. Old machines and old tools no longer meet the task of speed, quality, production cost. New tools refer to better and better methods for making the things that are demanded by national defense.

Originally considered as a tool machine to speed the drilling of hardened steel and to cut down losses on scrap metal drilled the hole, "the drill" drills made in steel 1/2 in. and larger have rapidly developed into production tools so they were being bought normally with few many possibilities along this line. From their original limited use, they have taken a larger place among industry's tools and today are found in shops doing armor plate, spring steel, hard manganese steel in steel, brass, and hardened chrome steel ball bearings.

The hole, the steel, the engine, the drilling. Yet they do not work well on soft steel. They stand where the high speed metal drill leaves only a hardened impression on the work and a frustrated worker on the job. Hardened drills do three jobs—drilling, counter-boring and counter-boring on hard steel and hardened steel pieces, and they remove the work well after manufacturing in metal pieces which in the past have produced stress and metal work up.



AUTOMATIC BACKING BAR

increased to over 50 percent in efficiency plus making it possible for much easier to work on the same machine simultaneously now as reported by use of new automatic backing bar together with improved design. Developed by Research Department of Henry Corp. of London, this bar is used automatically drills and shapes each hole eliminating any tool change time to setting operation.

Machine Tool Builders . . .

the men behind our war production achievement

IT TOOK GERMANY six years to get ready for this war, and Japan even longer. But in less than twenty-five months American industry, starting from scratch, has caught up with and surpassed the war production of the Axis.

When France fell in June, 1940, we unfortunately had no gigantic munition makers, like the Krupp or Skoda works, to turn to. We had been devoting our attention to making refrigerators and vacuum cleaners and motor cars and lawn mowers. Ordnance output for our Army was a mere million dollars a month. A sad commentary on our National state of mind and our lack of responsible leadership.

Yet during June of this year, our industries, transformed from peacetime patterns, produced close to a thousand times that amount. A thousand-fold increase in two years!

The same spectacular gains held throughout our war program—for ships, planes, guns, tanks, a thousand items. We are well on our way toward the 60,000 planes, 20,000 anti-aircraft guns, 45,000 tanks and 8,000,000 tons of shipping that the President asked us to produce in 1942, and toward the much larger production projected for the year 1943.

We are well on our way thanks to a number of factors, one of the most vital being the extraordinary job done by the machine tool industry. For it has equipped America's metal-working shops with the tools they need to turn out the vast quantities of war weapons.

The machine tool industry's importance springs from the fact that almost every metal product, from mechanical pencils to giant guns, is made with machine tools. They transform pieces of steel into parts for automobiles, farm implements and radios—and for airplanes, guns and tanks.

The Grand rifle, highly praised by General MacArthur at Bataan, has 72 metal parts requir-

ing 1040 separate cutting operations on machine tools. A 40-caliber gun mount is made up of 1900 separate parts, built to the tolerance of a Swiss watch. Each part must be machined, not once, but several times.

No wonder that when the American defense program was undertaken two summers ago, the American machine tool industry was the first to be called into service. Ninety-five thousand machines were wanted as quickly as possible from 250 builders who in peacetime had produced some 25,000 machines a year.

But the demand did not stop there. The Army, the Navy and the Air Force kept asking for more as the war production program was expanded again and again. Nor was that all. The entire anti-Axis world besieged Washington with urgent requests—from London to Moscow, from Ottawa to Chungking.

To a man the machine tool builders responded. New factories and additions to old plants were built, with deliberate disregard of the prospect that all these sharply expanded facilities could not be used after the war.

To increase output from existing plants practically every company went to two long shifts or three short ones. The industry's work-week was greatly extended. From the beginning of our effort, it has been the longest of any industry.

Working forces were enlarged from 40,000 to 110,000, and this latter figure does not include tens of thousands of employees with sub-contracting firms. Though machine tool building requires a higher degree of individual skill than most products, "turner" courses have been set up to train men quickly. Over 15,000 men and women now are in training.

The machine tool builders were among the first to go in for sub-contracting. They have furnished not parts, subassemblies and complete

machines right and left. To meet their needs, for example, repair shops of carpet mills are making ruffling machines, a laundry machinery company is producing radial drills, and an automobile body builder is making planers and boring mills.

Machine tool manufacturers quickly shifted peacetime practices to concentrate manufacture on the sizes and types of machines critically needed for the war program. They adopted mass production methods wherever possible, although machine tools are essentially a tailor-made product. They sent their sales engineers, as did machine tool dealers, to hundreds of institutions makers with available advice as to tooling up most efficiently for their particular jobs.

The swift action taken by the machine tool builders shows what private enterprise can do to meet a national emergency. They were the first to institute a voluntary system of priorities.

All of this involved an almost explosive expansion of the industry. Machine tool builders produced an average of only 7,500 machines a year from 1931 to 1934. In an ordinary year, output totals 25,000 machines. But in 1940, it rose to 132,500, and in 1941 to 187,500.

The 95,000 machine tools wanted for the original defense program were built and delivered within eight months.

Today more than 1,000 machine tools are being shipped to war factories every twenty-four hours, and for seven days a week. Each month's output exceeds that of an entire normal peacetime year and is five times that of the depression year of 1932. And each succeeding month is shattering all previous records.

It is this amazing performance that led Under Secretary of War Robert P. Patterson to declare that "machine tools are the foundation on which our production structure is built. American machine tool men are doing a stupendous job. Machine tools are now being turned out at a rate of \$1,380,000,000 a year. Machine tool designers have worked to improve tools so much that machine tool effectiveness today is one-third to one-half greater than it was in 1930. Our production today is 16 times what it was—in capacity to cut metal—at the peak of the World War.

The results of this performance by this key industry, so satisfying to the Nation, do not spring wholly from the numbers of machine tools produced. They stem also from their improved quality and greater productivity.

Today's warfare differs radically from that of 1917-1918. It calls for mechanized weapons so complicated in design and built to such a fine degree of accuracy that they are beyond comparison with the weapons of a generation ago.

Machine tools, completely redesigned during the depression years, are meeting these new and exacting requirements. In addition, thousands of machine tools of special design, without counterpart in peacetime work, have been built.

The record of the war industries most directly dependent on the machine tool industry speaks for itself. One tank manufacturer alone is producing more than thirty big tanks a day. A machine tool plant is completing 35 anti-aircraft guns a day, round the clock without interruption. A tank engine factory, loaded up to make 650 units a month, is actually building over 1500 a month. Des Moines bombs, designed for Russia and Tokyo, are being made by the tens of thousands every month. Machine guns are being produced at a rate of 50,000 a month.

These manufacturers, all machine tool users, are far in advance of the timetables set for them.

All this is good news for the American people and bad news for the Axis. It is proof that American industry, with each individual and specialized industry doing its part, is living up to the faith put in it by the American people.

But it is more than that, too. It is a guarantee of our confidence in the peacetime future of American industry and of the free enterprise system under which this miracle has been wrought.

Perhaps more than anything else, the foundation of that confidence must be faith in the foresightfulness, the ingenuity, the engineering and designing staff, and the managerial know-how of the machine tool makers.

On them we depend for the most essential tools of the post-war production economy. Without them, our vision of better living standards and full employment through more efficient production and distribution can never be more than a vision.

What they have done as the toolmakers for war is proof of what they can do as the toolmakers of peace. How they have done it as free men is a demonstration of what free men will do.

James H. McCreary, Jr.

President, McGraw-Hill Publishing Company, Inc.

Robot Painter Speeds Production

AN AUTOMATIC PAINTER for spraying small landing parts, usually with five times, does it a third the time the work formerly done in 35 years, has been installed by the Glenn L. Martin Co.

FIG. 1. Shows small parts being placed on an endless belt which carries them into the paint chamber from which fumes are drawn off and filtered through water to eliminate fire hazard. This is the beginning of a sand bag which will be both sides of steel landing parts given a speedy thorough coat of protective paint.

FIG. 2. Whipping back and forth across the endless passageway of small parts are automatic spray guns, spraying in even and all sizes, non-aqueous paint in parts which will help make up a bomber. Two such units are used in the process.

FIG. 3. After going through the paint spraying and washing sections the parts move through the air-dry zone and then drying and lamping can be turned on or each at their own making it possible to increase speed of the machine.

FIG. 4. Nine parts painted in one file are turned over and stored on the second pass of the operation a duplicate of the first.



Redesign and New Material Reduce Machine Work

Business which enjoy the windings of the Kithames "Teleplex," a device which transmits the motion of one instrument or part to the dial of another instrument (where counts indicate the accuracy) have long been installed these plastic. A phenolic plastic, which has to be compression molded, was used because work plastics have certain disadvantages: they do not change dimensions significantly as other plastics

do. In compression molding, however, if pressure is applied to both dimensions, either required thickness, length, width, which is spread shaped and bent several times, had to be maintained all around. This, of course, was an expensive and time consuming operation and had up to machine which could be used to achieve large in order work.

Through cooperation with a moldmaker, it was decided to use a thermoplastic which could be molded by the injection method. As the process of making a mold with close fitting parts and one



Design which enjoy the windings of the Kithames "Teleplex." The mold part only was compression molded of phenolic plastic and needed considerable machining to finish. The new part right is a thermoplastic molded by the injection method and requires almost no machine work.

which is sheet before the plastic is injected, very close finish on dimensions could be held and the molded parts produced almost entirely free of flash, the latter being so slight that even the flash-free finish, which is the piece. It was found necessary to employ a spread grade of cellulose acetate having much greater dimensional stability than the common type. The net result is a molding which has not only met requirements but requires almost no machine work. In fact, the only machining needed is to cut off the sprue (which fills the hole through which the plastic is injected) and to drill eight holes, very rapid and simple operation. In consequence, cost is greatly reduced and production speeded without any adverse effect on the performance of the part.

North American Produces Dash Fasteners

To ensure adequate deliveries of Dash high-speed fasteners, North American Aviation has begun production for its own use under license of the patent company.

The new unit of the fastener, used to secure control and other movable aircraft parts, is the dash, a complete screw machine part with a flat slotted head and a hollow shank. In second size with standard position, the dash is produced in Dash and Sharp screw machines.

Each dash has two irregular slots, one on each side of the shank. North American engineers have devised a hand-operated lathe for cutting 1000 dashes a day. This device is mounted on the table of a standard milling machine, the pump and prying of which supply cutting interest.

The dash are placed by hand in a vertical slot, feeding by gravity to a

(Continued on page 127)

RYERSON



Reliable Source of
Supply for
SPECIAL AVIATION
STEELS

Specialized skill and experience built up in 100 years of steel service to American industry—vast ranges of steel which move steadily through our great Ryerson plants into war production—are at attention's command.

For example, recently eighty-seven bombers were held up awaiting delivery of 2 1/2 tons of WD-X-4130. A Ryerson Steel-Service man was called at his home on a Sunday evening. Within a matter of minutes, Ryerson stocks in two cities were being checked. All were tempo-

rary one of the desperately needed item—all but one.

A shipment of 2 1/2 tons of WD-X-4130 rounds was just arriving at one of the Ryerson plants. The car was immediately opened and the same evening the steel was on its way to the airplane builder. A production bottleneck was broken.

When steel is needed is a hurry—and it often is, under pressure of war production—call Ryerson! If the required steel is to be had anywhere, Ryerson can, and will supply it!

JOSEPH T. RYERSON & SON, INC.
Chicago, Milwaukee, St. Louis, Cincinnati, Dayton,
Cleveland, Buffalo, Boston, Philadelphia, Jersey City

How TO ORDER GAGES

When an order for fixed size gages fails to include complete gage specifications, the missing information must be gotten by further correspondence before the order can be put in production. This delays procurement of these vital tools and it also puts an extra burden on the time of procurement personnel. Both can be prevented by including all the following information on gage orders.

PLAIN PLUGS and RINGS	SNAP GAGES	THREAD GAGES
 <ol style="list-style-type: none"> 1 Size (Go and Not Go). 2 Class of gage material's tolerance. 3 Whether desired—Go, Not Go, Double. 4 Length of threads—standard or extra long. 5 If progressive, number to be set and used. 6 Complete working instructions. 	 <ol style="list-style-type: none"> 1 Frame size. 2 Frame model. 3 Range. 4 Regulate whether gage is to be set and used. 5 Complete working instructions. 	 <ol style="list-style-type: none"> 1 Size (Go and Not Go). 2 Threads per inch. 3 Class of fit for the work part. 4 Class of gage material's tolerance and pitch diameter. 5 Whether wanted—Go, Not Go, Double. 6 Complete working instructions. 7 Whether or not a setting plug is to accompany a ring gage. 8 If setting plug is ordered, whether ring gage is to be set and used.

It is always strongly recommended and good practice to order a setting plug for every thread ring gage purchased because there is no other good way of accurately checking ring gage wear or of resetting the ring gage to dimensions for that wear.

The gage maker does not set and a thread ring gage unless he also furnishes a setting plug. He cannot do this because of the three variables involved, pitch diameter, lead, and thread angle. Every one of these is interrelated and every one may vary within its own tolerance zone. Thus, a thread plug and a thread ring made at different times or by different manufacturers may both fit well within their tolerance limits in every element and still, because of these small cumulative differences, the two might not fit together properly. When both the ring and the setting plug are made together, these differences can be adjusted, but not otherwise.



THE **SHEFFIELD**
CORPORATION
DAYTON, OHIO, U. S. A.

TAYLOR *Laminated Plastics*



Taylor Laminated Plastics Corporation is replacing metal for such aircraft parts as trim tabs, servo-tabs, wing tips and other sensitive areas on a growing list of bombers and combat planes.

Notable examples are the outstanding Martin B-16 B Bomber (illustrated) and the Bell Airacobra P-39 Interceptor Pursuit Ship.

Taylor drew upon its broad experience in the manufacture and application of laminated plastics to produce a seamless, one-piece construction that could be made in volume, that would resist any tendency to vibrate or ripple under stress, that would be a self-supported structure requiring no internal framework, that could be delivered to the plane manufacturer in finished form ready for installation, that would offer the smooth surface finish desired and possess the resilience necessary for quick and complete recovery from deflection under severe loads. This material—half the weight of aluminum—not only decreases weight and saves this vital metal but its characteristics also tend to dampen vibration in the aircraft.

TAYLOR FIBRE COMPANY
ROXBOROUGH, PA.

PACIFIC COAST HEADQUARTERS: 246 South San Pedro Street, Los Angeles, California

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AMINATED PLASTICS • Vulcanized Fibre • Phenol Fibre • SHEETS, RODS, TUBES, FABRICATED PARTS

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Emerson Electric Motor for Aviation Propeller Feathering



Emerson Electric Motor for Airplane Windshield Wiper

HELP FOR AVIATION
...From the Log Book of Experience



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CARRIERS OF BOMBS, that blast the enemy, depend upon many electric motors. They help provide the necessary smooth-working fighting power for pilots, gunners, and bombardiers need for control of the air. To this vital work, Emerson Electric Motors are making an active contribution. From the Emerson Electric log of experience (54 years of it) comes help for Aviation—proved ability to build electric aircraft motors for radio transmission equipment, hydraulic units, fuel pumps and tail controls.

Emerson Electric Motors are rolling off the production line—going to work in the skies.

For engineering service—for precision-built aircraft motors—consult Emerson Electric.

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ACCURATE CORES.. Speed Production of Precision Castings

Speed is all important these days....but so is accuracy. You'll get both in core castings by National.

1. Special formulas for core sand and core spray have been developed over a period of 50 years to take care of each individual requirement.
2. Skilled foundrymen mix these formulas under laboratory control in machines designed especially for this purpose.
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National's skilled men, expert supervision, good materials, modern machinery, give you accurate cores which speed the production of precision castings.

Blackout Ventilator

Blackout ventilator for factory windows that admit air and prevent light escape when "open" but shut out the "close" when closed, have been developed by Bruce Friling, and Merle Hirsch of the Lockheed Aircraft Corporation's plant engineering department. The double-lensed lens is leak resistant. Lenses have been installed throughout the company's plants where tests have shown some temperatures were between 5 and 9 deg. when the window lenses at only 25 percent of the ventilator were "opened" to admit outside air.

The metal ventilator core and its construction with fiber board "spacers" in ratios of 1 to 4 and 1 to 6 in each window frame, entirely replacing glass panes. In case of sudden pressure changes, any core of bonding is self-expanding, the fiber panes would be blown out—or in—thereby relieving the pressure on the metal ventilator and removing the danger of serious cracking from living glass and, possibly, the metal panes.

Patented by the Lockheed company, the new ventilator is being manufactured by the Rock Manufacturing Co. of Los Angeles and distributed by the Johns-Manville Co.

REVIEW OF PATENTS

By ELTON H. BROWN, JR., Patent Agent

Following are digests of the more significant of recent patents on mechanical developments announced by the U. S. Patent Office:

Aircraft Window Lens, 2,510,114, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,115, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,116, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,117, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,118, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,119, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,120, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,121, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,122, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,123, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,124, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,125, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,126, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,127, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,128, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,129, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,130, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,131, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,132, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,133, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,134, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,135, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,136, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,137, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,138, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,139, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,140, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,141, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.

Aircraft Window Lens, 2,510,142, A. W. Manning, inventor. A device which admits air and prevents light escape when "open" but shut out the "close" when closed, is described in terms of a process, which is a mechanical device, and a process of its production.



Double-lensed window "lenses" developed by Lockheed plant engineers are described by Bruce Friling as described. Used in combination with fiber-board "panes" it is adaptable to other "open" or "closed" panes for ventilation, but permitting in range of light as other panes.

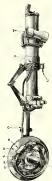
THE NATIONAL BRONZE AND ALUMINUM FOUNDRY CO.

Twin Plants

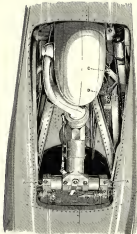
Cleveland, Ohio

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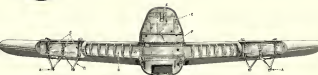
AVIATION August 1943



At left is shown the landing gear strut of the North American design with the wheel removed to show the linkage mechanism of "A". The wheel is normally mounted on the axle "B" with the brake drum overlying the brake mechanism. The hydraulic pressure line "C" is applied to the piston in cylinder "D". When pressure is applied the piston in cylinder "D" is forced outward to move the linkage "E" and expand the landing gear "F". The spring "G" returns the landing gear to its retracted position when the hydraulic pressure is released. This pressure line is attached to the line from the cockpit at "H". The wheel strut is hinged on its axle at "I" which permits the landing gear to be retracted. Landing extension is forcing which is attached to the strut at "J" follows the path of the strut and corrects the roll in the landing of the wing.



Shown above is the test wheel of the Martin 167-B* in retracted position. The wheel and strut assembly is hinged along its axle at "A" and is moved into the down position by means of a hydraulically operated piston shown at "B". Shown also are the chamber and valve controls at "C" and "D" for other details of the Martin 167-B* see *Aviation's Month Book* for February, March and April 1942.



Above is a front view of the retracting wing section of the Martin 167-B*. The landing gear extends into the nacelle of the wing panel "A". A tapered track roller "B" moves the wheel into the front wing bay. At points

of attachment of the rear section the gear is supported with heavy structural members "C". All the struts and hydraulic lines leading out from the fuselage to the engine nacelles are forced through the landing edge of the

wing at "E". The landing ballhead "F" is attached to the front spar of the landing gear and is moved into the ballhead by the mechanical elevator "G". The 167-B* is shown shown at the Martin Maryland.



NORTH AMERICAN AVIATION
B-25 TWIN ENGINE BOMBER

Uses

VICKERS

**HYDROMOTIVE
CONTROLS**

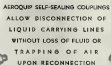


Engineers and Builders of
Oil Hydraulic Equipment
Since 1921

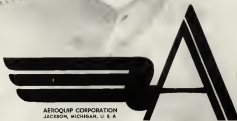
Vickers Hydromotive Equipment is used on many of the most modern airplanes. North American Aviation's B-25 Medium Bomber illustrated here is representative. Vickers Hydromotive Controls are high pressure oil hydraulic controls that are so widely used because they do the job dependably, smoothly and accurately . . . no matter how severe the service.

VICKERS Incorporated 1462 OAKMAN BLVD., DETROIT, MICHIGAN

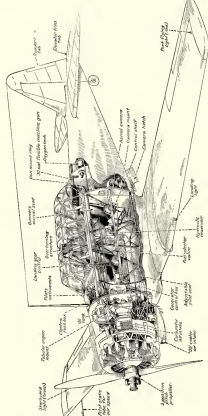
AEROQUIP HOSE LINES



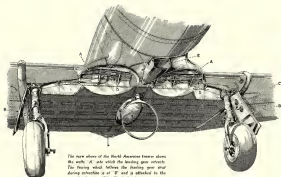
AEROQUIP SELF-SEALING COUPLINGS
ALLOW DISCONNECTION OF
LIQUID CARRYING LINES
WITHOUT LOSS OF FLUID OR
TRAPPING OF AIR
UPON RECONNECTION



AERQUIP CORPORATION
JACKSON, MICHIGAN, U.S.A.

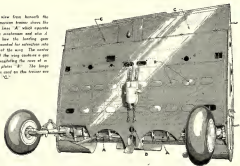


There is, there is a category race of the North American have reached jobs from school day have described the future has of business, entering the H's, the current AFM and the Canadian receive the 'flavour' in which thousands of American and British combine jobs that good education the body put to good use as barely at' are the year's



This rear view of the World American shows the work: 'A' are which the landing gear struts. The struts which follow the landing gear strut during retraction is at 'B' and is attached to the fuselage by the struts 'C'. The hydraulic pressure lines which lead from the engine to the struts are shown at 'D'. The gear mechanism is shown at 'E'. The gear 'E' shows the air intake for the engine.

Another view from beneath the World American shows the hydraulic lines 'A' which operate the landing gear and also the landing gear struts. The landing gear strut is mounted on retraction into the wing. The center section of the wing contains a gas tank, incorporating the main oil tank. The large type flap and the engine are shown at 'G'.



HAULING THE **BIG** LOADS ALOFT

You will see it soon—air transport on a tonnage basis. The world will use it... as we now use the steamship. And the bigger ships that are on the way will rely on power by Wright.

WRIGHT Aircraft Engines

Dependable Hose Clamps
for every aircraft need

WITTEK Aviation HOSE CLAMPS

Designed, built and tested for aircraft use, Wittek Type F Band FBA Stainless Steel Hose Clamps are used by leading aircraft manufacturers, engine builders and commercial airlines as the standard Hose Clamp of the industry.



WITTEK MANUFACTURING CO. 4305-15 W. 34th Place, Chicago, Ill., U.S.A.



SHEET NUMBER D-2
CLASSIFICATION Design—Materials
SUR CLASSIFICATION Stainless Steel

Stainless Steels in Aircraft PARTS AND CORRESPONDING SPECIFICATIONS

USS 18-8 ANNEALED

PHYSICAL DATA (MINIMUM)

Tensile Strength 35,000 psi
Tensile Strength 75,000 psi
Elongation in 2" 40%

FINISH

Hot Rolled, Annealed, Pickled, ...

APPLICATIONS

Fire Walls, Bulkheads, ...
Cooking, ...
Columns, ...
Spars, ...
Air Intake Manifolds, ...
Radiation, ...
Fuel Tanks, ...
Oil Tanks, ...
Steer Wires, ...
Fuselage, ...
Wing Center and Wing Connection, ...
Wing Bolts, ...
Water Tanks, ...
Tail Surfaces, ...
Dash Racks, ...
Dash Shuttles, ...
Dash Clamps, ...
Fuel and Injection Lines, ...
Gas Boost Cyls, ...
Welder Gasoline, ...
Straps, ...
Ratchet, ...
Spare Parts, ...
Pipe and Tube Fittings, ...
Nose and Tail Caps, ...
Fuselage Fittings, ...
Corrosion, ...
Fuselage, ...
Trusses, ...
Rudder Frame, ...
Nose and ...
Bolts, ...
Nose, ...
Angle, ...

USS 18-8 HALF HARD

PHYSICAL DATA (MINIMUM)

Tensile Strength 120,000 psi
Tensile Strength 120,000 psi
Elongation in 2" 15%
0.015" and over, 15%
0.015" to 0.030" in, 15%
0.030" and over, 15%

FINISH

Annealed, Pickled and Cold Rolled.

APPLICATIONS

Fire Walls and Angles, ...
Cooking, ...
Columns, ...
Spars, ...
Air Intake Manifolds, ...
Radiation, ...
Fuel Tanks, ...
Oil Tanks, ...
Steer Wires, ...
Fuselage, ...
Wing Center and Wing Connection, ...
Wing Bolts, ...
Water Tanks, ...
Tail Surfaces, ...
Dash Racks, ...
Dash Shuttles, ...
Dash Clamps, ...
Fuel and Injection Lines, ...
Gas Boost Cyls, ...
Welder Gasoline, ...
Straps, ...
Ratchet, ...

USS 18-8 FULL HARD

PHYSICAL DATA (MINIMUM)

Tensile Strength 160,000 psi
Tensile Strength 160,000 psi
Elongation in 2" 10%
0.015" and over, 10%
0.015" to 0.030" in, 10%
0.030" and over, 10%

FINISH

Annealed, Pickled and Cold Rolled.

APPLICATIONS

Columns, ...
Wing Spars (complete off parts), ...
Steer Wires, ...
Fuselage Cover and Structural, ...
Fuselage, ...
Spars, ...
Wing, ...

Aluminum Steels and Corrosion

Dash Racks, ...
Dash Shuttles, ...
Tail Surfaces, ...
Straps, ...
Plying Dash Racks, ...
Rudder Tray Surface Coverings, ...
Lattice Members, ...
Lattice Members Longitudinal, ...
Landing Gear, ...
Mainstream Fittings, ...
Fire Wall Brackets, ...
Fire Wall Brackets, ...
Rudder Frame Ribs, ...

USS 18-8 CB (ANNEALED)

PHYSICAL DATA (MINIMUM)

Tensile Strength 160,000 psi
Elongation in 2" 40%

FINISH

Hot Rolled, Annealed, Pickled and
Passivated

APPLICATIONS

Exhaust Manifolds, ...
Cabin Heaters, ...
Dash Racks, ...
Cylindrical Air Intake Tubes, ...
Fire Walls, ...

USS 18-8 TI (ANNEALED)

PHYSICAL DATA (MINIMUM)

Tensile Strength 100,000 psi
Elongation in 2" 40%

FINISH

Hot Rolled, Annealed and Pickled.

APPLICATIONS

Exhaust Manifolds, ...
Cabin Heaters, ...
Dash Racks, ...
Cylindrical Air Intake Tubes, ...
Fire Walls, ...

Installing a *PLEXIGLAS* nose



PLUMMER has seen active military service since 1964. In a questionnaire returned, you state "cavalry, helicopter, administrative duties, rifle weapons, and assemblies, leading both cavalry and infantry units." PLUMMER's qualifications qualify as those seen in the picture of the Commanded P-4 are to be found on every kind of fighting plane used in America.

To provide designers and engineers with practical information on proven methods of installing FIBERGLAS sections in aircraft, Rohm & Haas has just published a *FIBERGLAS Methods of Installation* manual.

This 10-page booklet not only contains a number of specific suggestions for mounting PLACODAS, but also outlines the considerations behind these designs.

Copies are available to interested aircraft engineers and executives.

THE CRYSTAL-CLEAR
ACRYLIC PLASTICS

PLEXIGLAS
SHEETS AND RODS

CRYSTALITE
MOLDING POWDER

Training and Payments for the Adjudicator, R.g. 1: 1. For CE, for the month of December the assessment by the State & Court Company



SPECIES TAGS

For measuring PLURALITY, nothing is already, the new PLURALITY Methods of Investigation hardly measure (if only directly) number in the most direct sense. From the very start, the

ROHM & HAAS COMPANY

848 MATTHEW S. SOBEL AND JEFFREY A. DIEHL

Manufacturers of leather and textile goods, and clothing. Exports: leather goods, leather, fur, clothing, and other leather goods.



*To keep you posted
on New Developments*

AVIATION

presents . . . a NEW FREE SERVICE

For busy aviation executives, Aviation inaugurates in this issue a new easier way to keep up to date on the latest developments in the industry.

Each month, through the cooperation of aeronautic and allied manufacturers, Aviation's editors gather information on significant current developments. In concise, quickly-readable summaries this information is presented in these pages.

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On the following pages are presented for the aviation industry . .

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- 2 **New Products and Equipment**—Terse, informative reports of new developments in aircraft equipment, materials, parts, instruments and accessories, plus aircraft production, machinery, tools and plant equipment.

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This is your service. Use it freely. Build a file of these helpful new ideas to speed your work—to aid in solving some of these tough problems. Take full advantage of this practical way to keep abreast of the latest developments in this fast-moving industry.

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This AVIATION Reader's Service is being made available through the cooperation of manufacturers to help executives save that invaluable item—time. It is your service to use—a service which can mean a profit in both time and convenience.

Motor Cars—A Daily To Whom Do—Motor Cars is the subject of a new booklet designed for use in phone work around the clock on war related matters. It is designed to tell you everything in handling or caring for motor. It has been published by Alfa-Chrysler, Milwaukee, Wis.

Electric Converter Type—A production in page covering mechanical drawings and illustrations of electrical converter types with their when, where and how to use features, plus existing ratings and part lists of recent converter units published by the Eassey Engineering Co., Inc., 40 E. 115th St., New York, N. Y.

Speed Changer—A 31 page illustrated design on fast Delta PIV variable speed changer explaining the design principles telling how to select the proper gear, showing engineering data, telling how it is built and giving dimensions of the design in form. Published by the Stark Bell Co., 301 N. Michigan Ave., Chicago, Ill.

Aircraft Production Equipment—A booklet by the Lincoln Electric Co., 500 Madison St., Geneva, N. Y., is Section 8 of the Aircraft Equipment catalog, describing and illustrating the company's hydraulic hoists, strutting, cable-body trolleys and rollers, aircraft jacking devices, portable crane, propeller drill, spin and lift cranes and other equipment.

Motor Power—Based as a new leader in new service—No. 1741—illustrates representative types of motor power, valve control and carriers built to meet needs of power and instrumentation in production. The P. E. Myers & Co., Inc., Ashland, Ohio.

Principles—Covers eight topics on power systems, electrical equipment, power systems, wiring and establishing power ranges, scheduling production and delivery, and adjusting machines. Originally prepared to meet the jobbers and their sub-contractors. 161 pp. book. Let order: Precision Sheet Metal Production for Turret Gun Lens made available by Thomson, Brownell & Sons, Bridgeport, Conn.

Delta Pattern—It gives probably the latest cutting drawings under the belt cutting 40-in. wide line of make one parts manufactured by J. W. Miller Co., 2011 S. Main St., Los Angeles, Calif.

Spot Welding—It gives cutting drawings, control elements and the various types of spot welding and roller frame, variable voltage. A description of the new type of automatic weld tower for use with one or more separate power units is included in this latest edition of the book—No. 45—published by the Power Equipment Bldg. Co., Boston Harbor, Mass.

Wire Gages and Wire Clerk Products—A 16 page catalog covering selection, order, use and engineering data on wire cloth and wire mesh. Catalog G. Newark Wire Cloth Co., 248 Tenth Ave., Newark, N. J.

Wrench Instruments—Bolters 20000 catalogue. It gives a complete listing of Wrench Instruments Co.'s complete line of measuring and control instruments. Describes and illustrates with construction of inspection methods. Includes the company's "Reference Principles" for metal. Wrench Instruments Co., Racine and Peoria Ill., Chicago, Ill.

Grinder Wheel Catalog will follow on 1611 Grinders Wheel Paper and Lightly contains practical tips suggested by first men for the art and science of grinding wheels. It gives both general information as well as specific instructions and dimensions designed for general use. The Standard Wheel Company, 330 W. Duane St., Chicago, Ill.

War Workers' List—The First and last edition of the first published report of the Committee on Statistics in Industry of the Standard Research Council based on surveys covering design and material deficiencies, personnel and industrial health.

problem a comparison with British experience considerations for industries related to their modern health and recommendations of the committee. Copies available without charge at the Food and Station Board National Research Council, 1101 Constitution Ave., Washington, D. C.

Electrician and Electrician—New study outline designed to help men of electrical and mechanical in today's companies with stock, parts. Catalog No. 14. Ontario Manufacturing Co., 4601 Thurney St., Chicago, Ill.

"First Fit" Welding—Titled the First Fit Welding Technique for spot welding. This 16 page booklet has been placed as reference material for plant production officials, welding operators and all others concerned with welding. Text, photos and sketches compare the First Fit and other welding techniques as to angles of electrodes, and penetration, metal strength, dependent on initial and control of welding, for both single and multiple path welds. The Lincoln Electric Co., Cleveland, Ohio.

Lighting Plans—Two recent issues of Plans published by the Electric Power Steel Corp., Boston, Mass. are probably illustrated by this production. Contains information on the company's industrial sector on design and lighting problems which can be handled through 41 formulas.

Stainless Steel—Two booklets on Republic Steel Corp.'s Stainless steels steel, one of 54 pages on welding of stainless steel by the principal commercial processes. Illustrated with related materials and products, also proper and improper welded designs. The other, a 40 page booklet on stainless steel procedures for cleaning, blasting, drying, spraying, rolling of welding, annealing, cold and hot forming, machining, forging, rolling, other heating, annealing and pickling, pickling, pickling, rolling and welding. Republic Steel Corp., Cleveland, Ohio.

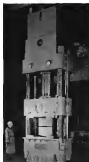
MINUTE on NEW this new free service

For the informative literature reported on these pages—or for more information on the new products described—simply fill in the Request Form below,* clip it to your letterhead and mail. There is no cost, no obligation.

MODERN MACHINE TOOLS

Hydraulic Press

A new "high mounted" all-hydraulic press has just been introduced by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, which is said to require less



floor space than conventional presses, since the motor power is an integral part of the machine, mounted above the press. By eliminating the base, transfer and accumulator only one dimension—that of the press itself—is required. Lower maintenance costs are claimed since all pressure and working parts are contained in the operating machine, a high grade engineering oil

which is continuously cooled and filtered. The new press, the 3115, shows exact operating speeds, the HPM patented surge valve and the company's hydro-power radial variable delivery of pressure pump—Aviation, August, 1942.

Job Crane Welder

A flexible installation for production spot welding in assembly of light-gauge aircraft parts, including standard steel types, has been developed by Frigman-Welder Co., Detroit, Mich. The primary module refrigerated electrodes, variable throat-depth, and welding transformer built into a light weight welding gun and a job crane with 4-ft. pole-type arm. Being complete, self contained, with all units mounted on, or suspended from the job crane, the equipment facilitates installation and provides a wide area, over which the equipment may be moved, permitting its working on large assemblies or on assemblies with moving components. As an

additional flexibility feature, the hooper is so designed that the gun may be revolved 360 deg. in any plane, facilitating welding in normally hard-to-reach places on an assembly. The gun may be adjusted for throat depth by changing the electrode arm. Of the air operated type (direct connection to factory air-line system), it normally carries relatively small diameter electrodes. This permits obtaining of the needed weld



ing pressure per square inch through a simple air cylinder mounted on the gun—Aviation, August, 1942.

AVIATION READER'S SERVICE AUGUST

INFORMATION TYPE
Please send me the following information described or identified by key numbers listed:
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

NEW PRODUCTS

Please send me new information on New Products according to key numbers listed:
17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54

NAME _____
TITLE _____
COMPANY _____
ADDRESS _____
CITY AND STATE _____

IT MAY LOOK LIKE A Gadget



BUT IT MEANS FASTER, SAFER WIRING...

The removable large terminal shown here on the Type K Smythe Cord Connector is patented Cannon feature which applies to both Types K and AN.

It permits the removal of large terminals so that wires may be soldered either by the torch or solder-pot method. Since the greater heat required to solder the heavier connections might melt adjacent ones or burn the insulation, the removable terminal provides a distinct advantage not only in convenience but in time-saving and safety.

This is a typical example of the care which Cannon Engineers give to the small details—details that make a tremendous difference in the finished product.

Open spring clip from large terminal by sliding outward and upward.



Insert this operation on the other side of the small spring clip.



Remove spring clip, give heat terminal a specific heat. Lift out for soldering as shown at top.

CANNON ELECTRIC
DEVELOPMENT COMPANY
LOS ANGELES, CALIFORNIA

Hydraulic Riveter

A new two bar lock-wire operating machine using 90 lb. air pressure between the rails for handling large work is announced by **Loba Engineering Corp.**, Berkeley, N. Y. The new machine is self contained with



pneumatic unit, including pump tank, mounted on top. Upper and lower cross members are of welded 3 beam construction to assure rigidity at all points laterally. The riveter is mounted on the upper cross member and the air to the lower member. Manually operated valve controls pressure of the moving downward and return strokes. Specifications are as follows: distance between beams, 21 1/2 in.; distance between air rails, 9 ft. 10 in.; stroke, 3 ft. 1 in.; diameter max. 5 in.; bar in top of bar, 4 ft. 3 in.; overall length 10 ft. 6 in.—*Aviation*, August, 1942.

New Boring Tool

An entirely new boring tool for removing burrs from the inside edges of multi-milled parts has just been announced by the **Walter Mieland Company**, 6736 Inca, Shasta Blvd., Oakland, Calif. It cuts burrs due to a mechanism by eliminating small methods such as simply in construction and operation.

Used as a drill press, lathe or other machine spindle, it is kept in constant motion while parts are fed to it as



AVIATION August 1942

fast as the operator can handle them. It consists of a cylindrical shell which pivots in the hole to be deburred, to one of which is fastened a tapered roller. This roller is a free-rolling ball bearing that can be grasped and held by the hand eye while the shell is rotating. By sliding the roller up or down the bearing blade can be advanced into cutting position as required.

The cutting blade is of special tool steel, and can be easily and quickly removed for resharpening, and when completely worn down can be replaced. All essential parts are case hardened and ground.

The new tool, which can be handled by inexperienced operators with speed and accuracy, is available in 1/16 in. progressive sizes, from 3/16 in. to 1 in. and others can be furnished.—*Aviation*, August, 1942.

21

Metal Former

Prodigious amounts in overall production are going in 45 days. That of heavy, hand forming methods, are claimed for a Metal Forming Machine just announced by the **Southern Engineering Co.**, 825 W. Fifth St., Los Angeles, Calif., as the basis of reports from eight successful manufacturers already using the machine. It was developed to reduce labor time and costs in forming extruded sections in various shapes.

The machine consists of two large sections: the movable head into which the dies are loaded, and the air ram to which the forming die is attached. A 5 hp. variable speed variable maximum motor drives the belt, through roller take gears and a piston system, at an adjustable range of speeds between 60 and 275 in. ft. of travel per minute. Using

normal air line pressure available in practically any plant, up to 25 tons pressure is exerted by the air ram.

Thousands of extruded extruded sections into the desired form, which may involve any number of changes in shape as well as profile, is accomplished by attaching one end of the straight section to the movable die and then drawing it between the movable die and the die block located on the air ram. The work is tightly clamped to the surface of the die and any type extrusion can be formed to the desired shape without danger of warping, and with a minimum of material wastes.

Three types of movable heads are available: machine for forming parts with a symmetrical (only) or an irregular (only) with an straight extrusion; semi-circular, to form parts with straight surfaces, also curves, curves and offsets; and straight, which treats only in a straight line in form using two rails, straight and other longitudinal parts. Such materials as magnesium, steel, and stainless steel can be formed in the machine, in addition to aluminum alloys. With the use of a movable, rubber sections can be formed in metal or non-metal extrusions. It is possible to make symmetrical, tapered tubing. Hot sections 2 inches in width, in addition to tube bending, and all at higher speed of production and greater uniformity of the parts.—*Aviation*, August, 1942.

22

Internal Hone

Internal cylindrical surfaces with holes up to 24 in. in diameter and with key ways from 24 in. up to 24 in. can be honed accurately, quickly and economically on the **Speed Honing & Lapping Machine** available to the manufacturer, **Automatic Maintenance Machinery Co.**, North Chicago, Ill. Me-

chanical honing speeds up to large cylinders to be placed on standard lathes. Versatility in stroke or height under the specific hole are only three of the ways in which the machine can be adapted to almost any type of honing work. Features are said to permit extreme accuracy and simplicity of operation. All controls are located at the front of the machine at the operator's station. Stroke setting, withdrawal of hone from the work, short stroking at any point, advance or retreat of workpiece, or rotation of the spindle, can be controlled from the front of the machine regardless of stroke capacity. Positive stop and drill system makes it possible to stop the spindle at the bottom of each stroke or at any point within the stroke range without shock to the machine or work being honed, and hold the spindle at that point up to 15 min.—*Aviation*, August, 1942.

23

Heat Treating Furnace

Due to demands on commercial heat treating plants, it has become increasingly difficult for small tool and die shops, and other manufacturers lacking



AVIATION August 1942

Announcing

A MANAGEMENT POLICY



THE new management of the ROMECPUMP COMPANY makes a pledge. That pledge is to produce and deliver aircraft pumps which in quality and performance will continue to be classed farther "out in front."

ROMECP engineers pioneered the non-pulsating fuel pump years ago, and ROMECP pumps were among the first to pump the fuel for the earliest globe-circling flights. Today they are pumping in places over 5 oceans and both hemispheres.

We shall not only continue to build pumps that improve with use but we shall constantly strive to build even better pumps, if that is possible. As the pilot cannot perform better than his heart, so the planes and motors cannot perform better than their pumps.

We repeat the pledge to keep ROMECP pump DEPENDABILITY "out in front."

THE ROMECPUMP COMPANY

Reph McQuest
 Ralph H. McQuest
 President

ROMECP

PUMP COMPANY

ELYRIA • OHIO • U.S.A.



25

Electric Muffle Furnace

The line of electric furnace units featured by E. O. Swoboda, Inc., 194 St. New Brighton, Pa., has recently been augmented by a new full muffle electric box type furnace with all refractory linings. Designed primarily for drying and glassing ceramics at temperatures up to 3,000 deg. the new EOM furnace is also highly efficient for heat treating high speed tool steels, hardening, tempering, and many other heat treat and laboratory heating applications. Principal advantages include low initial and operating costs, long operating life at maximum temperature and high heating rate. Maximum temperature is obtained in less than one hour. A highly desirable construction feature is the new type automatic control door which eliminates the manual and consequently much of the cost of the standard sliding door plus the advantage of always enclosing water from the surface thus preventing exposure to the heat of the inner door surface. Other construction features include a full box type muffle and all-refractory hearth, completely surrounded by heating elements which eliminate temperature variations in the hearth chamber. Chamber dimensions measure 30 in. high, 24 in. wide and 12 in. deep.—*Aviation, August, 1942.*

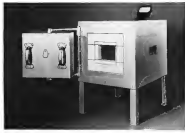
heat treating furnaces, to secure this important service. To offset this disadvantage, Quincy Electric Mfg. Corp., Indianapolis, Ind., builder of laboratory and heat treating furnaces, has developed two sizes of a small electric muffle furnace. Both are as follows: Type MII-4 has a chamber capacity of 8 in. wide, 8 in. high, 14 in. deep, and consumes 18,225 watts in outside and maximum power consumption, 3,600 watts. Type MII-4 has a chamber capacity 10 in. wide by 8 in. high by 16 in. deep and consumes 18,225 watts in maximum power consumption 4,800 watts. Operating temperature—1,200 deg. F. for continuous operation and 1,500 deg. F. for intermittent operation. Type MII-3 operates on both 115 and 220 v. circuits, while Type MII-4 is available for 230 v. circuits only.—*Aviation, August, 1942.*

alloys at any desired point by means of Flow-A-Pumps which are well constructed positive devices and dismountable. Reactions may be aided or retarded and the temperature made to Flow-A-Power in a matter of minutes. The Tredwell-Covore System provides safe and accurate power supply to portable electrical equipment, resistors, lamps, etc. All these systems are furnished in complete and logical with accessories, permitting fast, economical installation. Equipment contains no valves and requires less oxygen, steel and other vital materials than conventional wiring systems for a given power load.—*Aviation, August, 1942.*

24

Tredwell-Covore Systems

The Tredwell Electric Mfg. Co., Plainfield, Conn., makes three distinct related backup systems which may be used either separately or in combination to provide low voltage power distribution all the way from the motor transformer to point of machine load. The Low Voltage Drop Backed-Up Flow System is designed for use as motor feeder from transformer to switchboards, for use more in buildings and for feeding three-phase motors. A. C. D. drops in voltage as motor power leaves, even at full voltage at point of load. The Flow-A-Power System, designed for use as secondary feeder to point of machine load, permits plugging in mo-



SHOP EQUIPMENT & ACCESSORIES

26

Industrial Shop Truck

The *Inda Shopcar*, Harvey, Ill., affords the very, pusher-powered (front Bay) built for industrial work, for use in and around industrial plants. With a maximum speed of 20 mph, the *Inda*



top is built to average 25 to 28 mi. per gal. of gasoline. The top radius is 7 ft. 3 in. and rounded front bumper makes it possible to open bays there unassisted. The brake is applied automatically if operator leaves the seat. Speedometer indicates speed, 0-60 ft. per hour, 12.5 mph, overall length, 90 in., overall width, 26 in., wheelbase, 28 in. Engine is 1 cylinder, 4-cyl. is hand-cranked delivering 7.7 hp. at 1,500 rpm. with one speed forward and one reverse transmitted through a simple friction drive. Price is \$1,000.00, including wheel and—*Aviation*, August, 1942.

27

Portable Lubricator

Three new portable service stations for industrial lubrication are announced by the *Alameda Div., Bennett Warner Corp.*, 1800 Division, Parkside, Chicago, Ill. Each unit, a complete lubrication department in itself, meets the latest operation, is designed for mounting on hand or electric trucks, to enable air-lifted lubrication of equipment in all parts of a plant. Planned especially for the lubrication of air machines and valves, particularly in plants working at maximum capacity where maintenance time is immediately related to a machine, these portable lubricators

transportable equipment for fast, efficient lubrication. Features include use of equipment—each unit can be loaded efficiently by one man, or several operators can work from the same unit simultaneously—convenient hose layout to facilitate servicing of hard-to-reach bearings and bearings, combination control valve and meter for improving amount of lubricant used; outlets for both high pressure and volume lubrication; facilities for handling all grades of grease, oil, and solution compounds. Standard models, of four and six unit capacity, include a high pressure pump with 30 ft. of hose on reel, for power lubrication at pressure up to 100 psi, also low pressure pump with 15 ft. of hose on reel for lubricating gear lubricants and machine oils. Two or more hand operated low pressure pumps, depending on model one, for dispensing lubricants and oil and a hand operated pump for loading hand guns, are part of the standard model equipment—*Aviation*, August, 1942.

28

"New-Type" Speed Nut

Two "New-Type" speed nuts have been designed to solve both a real and a possible headache for the student of low load grade blocks. They also eliminate many handling operations, valves, and use of wrenches, when only a screw driver is needed for the assembly. This new self-pull nut is designed for use also in other applications throughout the work where fastening points are grouped



in pairs. They are manufactured with an offset center hole for centering or desired, and are in the following sizes which indicate distance from center in



center of screw holes: 1/8, 1/4, 3/8, 1/2, 3/4, 1 in. in which 1/8, 1/4, 3/8, 1/2, 3/4, 1 in. are *Aviation*, August, 1942.

29

Dual Recorder

For recording engine, radio broadcast, and other communications, the *Dual Recorder dual recording system*, offered by the *Radio Recorder Corp.*, 62 Jackson St., New Haven, Conn.



are 2 models of two recording drums mounted on a single 15(13) inch in diameter or independent cabinet suitable for either desk or portable use. Automatic timing mechanism shifts recording from one drum to the other at 15 sec. intervals. The top front section opens up to permit access to both turntables, tape, valves, gears and turntable carriers, and pin lock, automatic and manual backspins under possible immediate playback. The plastic record is 7 in. in diameter, holding 15 sec. of recording on each side—*Aviation*, August, 1942.

30

Bin Combination

The new "Bin-Comb" assembly equipment offered by the *Dorwin & Hall Co.*, 164 Longfellow, is designed to make the comparison of tool and equipment shown in picture and time studies to be essential for more production work. Working distance is held to



a maximum through the overlapping arrangement of bins in the rack, and shaping construction of the bins keeps a constantly accessible supply of parts at the front. Each bin is formed of a single piece of metal curved at the back to form a head, which locates it in any position in the rack, and each bin can be removed independently for filling. The racks can be placed in any position on a workbench and then are easily adapted to fixed condition of the workpiece or can be removed or are desired rotation in jobs. Extensive illustrations—*Aviation*, August, 1942.

United States Electrical Tools



**HARD-TO-REACH SPOTS
ARE NOW EASY-TO-REACH**

**United States
MODEL 14 ARD
by Harry
Duffy Aircraft
Special Drill
AIRCRAFT
DRILLS**



These little chaps go places . . . any place . . . without requiring operators to put on a contortion act. But . . . they're powerful, practical, economical . . . for production or maintenance.

**LET'S GIVE YOU THE
LOW - DOWN ON
THIS GREAT LITTLE
AVIATION DRILL.**



THE UNITED STATES ELECTRICAL TOOL CO.

CINCINNATI, OHIO, U.S.A.

Plastic Cleaner

A new plastic cleaner for removing grease, marking tape gum, res, rubber, shoe polish, rubber rollers on tape, tape, tape, is announced by **Amesst Industries Corp.**, 605 S. Ardmore St., Los Angeles, Calif. Known as



Amesst, it is said to be harmless to all kinds of plastic material, especially, and when used for a few days gives up less as a film that retains neither stains—*Aviation*, August, 1943.

Oil-Rite Lubricator

Of timely importance for the production of today's war machinery is this new **Oil-Rite Constant Level Lubricator**, made by **Oil-Rite Corp.**, Unit 5, 138-84, Milwaukee, Wis. It holds a constant reserve supply of oil—refuses automatically just as much as is needed to maintain a constant predetermined level of lubricant. Its use is said to insure adequate lubrication at all times and prevent oil leaks, and the deterioration or spilling of material caused by oil theft.

The lubricator is used on electric motors, gear works, pumps, or continuous equipment, rendering fast, easy, better—cheaper—lubrication when necessary parts must be provided with an ample supply of lubrication. Construction of the Oil-Rite Lubricator consists of only three simple parts. The base is cast of ductile metal, with an integral open end which allows part way up into the oil reservoir. Over this rest is fitted through an internal baffle, or bell, also cast of ductile metal. The reservoir proper is a glass dome, sealed to a metal roller by plastic, porcelain enamel, which is impervious to acids, alkalis, water and heat. Two spring clips lock the oil reservoir in position. A felt



point around the outside of the bell seals against the reservoir neck of the glass dome when the reservoir is removed—guards against oil during refilling. When reservoir "A" (in the accompanying diagram) is filled and inverted into position on the base "B", the lower edge "C" of the internal baffle or bell determines the oil level, while the lubricator will maintain a level level fully below this point, or from the neck "D" escapes under the side of the bell—oil is "A" up to the top of the lubricator, preventing oil to flow down and the level to be maintained against leaks under the base of the bell. Operation is entirely automatic—requires no moving parts of any kind. Remove the operating lever, provide keys, keys, separate passages for air and oil, the manufacturer explains, that the flow of lubricant is not restricted in any way. When used on machines that operate with intermittently, the chamber forward made the bell gas valves adequate venting capacity for oil flowing back to the lubricator—*Aviation*, August, 1943.

New Service Unit

A new portable unit for pumping and extracting heavy engine oils and greases from aircraft engines is now available. It is announced by the **Harman Engineering Co.**, 837 West 2nd Ave.,



Los Angeles, Calif. Known as "Lube-A-Flo" unit, the truckers are equipped with a hand filling device that enables one man to load 400 lb. barrels and bulk them in a third position. Power is supplied by engine or electric motor, and delivers 10 to 4 gpm. The unit, one plate with 30 D. hose, single 400 lb. larger low-wheel axle of 400 lb. or less, also includes a hand pump, air motor, August, 1943.

Alpert Cutter-Retriever

Capacities designed to cut wire with one hand or to dig up broken wires, to remove or to hold in a power fed grip with, bolts, washers, cotter pins, etc., at maneuverable points, the Alpert Cutter-Retriever will be distributed nationally by the **Zero-Rate Machine Corp.**, 828 N. Broadway, Glendale, Wis., who may later take



over the manufacture as well. This cutter-retriever resembles a probe—the cutting edge being located at the end



of the long thin barrel. To cut wire, the operator moves the probe the wire between the cutting edge of the "dual-use" of the probe and edge of the wire by bringing down the trigger which actuates a rod operating inside the barrel of the probe. The lever can move in 10 to 1, lower gradually as thumb pressure is required on the trigger. To remove a bolt, nut, washer, cotter pin, etc., which are too dropped into an inaccessible place, the "dual-use" barrel is slowly pulled into the hand-held place, the trigger brought forward and the hand-held steel cutter picks up the missing part—*Aviation*, August, 1943.

Fine Texture Abrasive

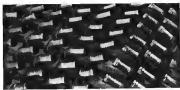
The **Welds Roberts Rubber Co.**, of 3200 S. 13th St., Newark, N. J., as part of the Brighting line of rubber reinforced abrasives, has added a new line of fine texture wheels known as



Brighting Wheels for abrasive work in grinding special finishes and finishes. Wheel runs under from 1 to 10, and from 1/2 to 1 in. with hand labor, wire, and other shapes, expected to be added—*Aviation*, August, 1943.

Niegara "No-Frost"

Cold room air conditioning providing constant temperature as low as 30 to 50 deg. F. are available for constant room required in test or sensitive parts, materials and machinery at low temperatures, and for experimental laboratories. Developed by **Niegara Electric Co.**, 6 E. 45 St., New York, N. Y., the Niagara No-Frost Method provides equipment for maintaining low room temperatures and also for reheating fresh makeup air to three times at correct low temperatures—no more large enough for full scale testing. This is equipment using Niagara No-Frost liquid (one hour) gas con-



The fine mesh can be used for welding, 1943, with right angle elbow, of the new and thin meeting hose of this.

Speed Up Assembly with REX-FLEX STAINLESS STEEL FLEXIBLE TUBING

Reo-Flex Can Be Readily "Snaked" Into Place In Cramped Installations Such As Elbows and Sharp Bends, Eliminating Joints.

Unusually smooth, completely malleable, stainless steel tubing, allowing air ducts, blast tubes, reheat shielding conduct, power plant accessory parts, oil and gas flexible lines by using Reo-Flex Stainless Steel Flexible Tubing. Extremely light in weight, bendable in multiple planes, obtainable in long lengths.



Only Reo-Flex is Applied Worked-Around-Around.

High Fatigue Value—Heat and Corrosion Resistant
Reo-Flex Stainless Steel Flexible Tubing is available in five wall-thicknesses, all of which can be connected in a single continuous length, with straight walls and corrugated sections at desired intervals. Sizes 1/16" to 2" O.D. (1/2" to 1" I.D.) Made of 18-8 (Austenitic) Stainless Steel. Fittings are attached to take weld by circular resistance welding.

No Flex, No Heat, No Quenching—Producing Absolutely Tight, Homogeneous Assemblies

Write and Engineering Recommendations or Export

CHICAGO METAL HOSE CORPORATION

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Pittsburgh, **MATWOOD AND ELGIN, ILLINOIS**



steel operation without interruption or loss of exposure by reason of use or feed. Feeding in center rolls in location of stations of the equipment from contact with loose or redone. It consists of modern operation in stages, the first stage reducing in temperature just about the freezing point at which will covering heavily, the second stage using the Niagara No-Frost Method to remove the balance of the moisture, and the third stage reducing and locking the required final temperature. Moisture is removed from the ice below 32 deg without causing formation of ice on rollers by the Niagara No-Frost Method which employs a special non-freezing liquid continuously to ensure freedom in a Niagara compressor (described separately) for this duty.—*Aviation, August, 1942.*

37

Blue Pearl Litterbox

Designed to speed production of blue prints is the new Engineering Model of the Van-Type Composing Machine, offered by the Ralph G. Goodall Corp., 333 South Ave., New York. Blackboard lettering of blueprints which formerly took a draftsman five to ten days can be done in a night in half a day, the company reports. The new model is a specialized machine designed employing a "super compound" with elastic bars, re-binding in each end of the robot typing element to permit handling of sheets up to 36 in. in length. The compound is available, so the operator can work on

any section of the sheet and a feed roll lever permits extension of the feeding roll beyond the rest of the manual carriage of the machine. Interchangeable cylindrical type bars make possible the use of a variety of styles and sizes of alphabets and spacing arrangement is suitable to accommodate alphabets with different width letters.—*Aviation, August, 1942.*

38

Revolute Copier

A new continuous type copier has just been designed by the Permaper Replicate Corp., 17 South Ave., Babylon, N. Y. Its making contact prints on selected light type photographic materials. This copier is known as the Replicate 88 Continuous Copier. It will make reproductions rapidly from any type of original up to 44 in. in width by any length. Reproduced images may be made from blueprints, black and white or colored originals, and will copy originals which are on either transparent or opaque materials and which are printed on either one or two sides.

The Revolute 88 Copier uses the principle of rubbing contact in order to prevent slippage and blurred prints. As for, the Permaper glass cylinders are provided and the original and original material in contact with this cylinder. On the inside of this cylinder are located three fluorescent lamps usually two white and one gold. The white lamps are used for making reproductions from black and white originals. The gold lamp is used for making reproductions from blueprints. Transparencies printed on one side only are reproduced by transposing light

out here to be handled in special dark room. No flammings are necessary, no lenses are required. Negatives on this new material are superior to those formerly made on acetate. Vaulsda reports because of the expansion of the background. Therefore, negative "spotting" operations are unnecessary, better reproductions may be made from dirty originals or from materials which contain general lines or other fine lines which are ordinarily blurred out.—*Aviation, August, 1942.*



through three sets of the sensitive material. Design originals which are printed on two sides are copied by reflecting or "hammering" light back onto the reversed material.

These new photographic materials do



High Landing of Conquest Flying Machine

...WHEN JOHNNY COMES Flying HOME



Above the clouds, through the screaming sounds of a night attack, comes the electric bark of guns. A cannon's cough pierces the skyplane where of screaming motors. There's a flash of flame.

Then, Johnny Comes Flying Home.

These few seconds flash back seven years to the start of the flightless plane that has since captured the imagination of men, everywhere. It's the story of blood, sweat, toil and tears through the years when Axis danger seemed a fairy story.

Johnny is flying a heavily armed Army Airacraft. It's generally considered the most deadly fighter plane on wings. With speed, fire

power and maneuverability on his side—with motor alt and guns out front—a cannon firing through the nose—the odds are with Johnny. Much of America's finest skill has been busy for years giving Johnny these odds.

And it's never too early to say that we are looking forward to the day when Johnny will really come flying home, to find his place in a new world of peace-time aviation.

Stepped up by the needs of war, we know America will have the benefits

of the mass production of planes to carry on its ceaseless and loyal in the skies.

But Johnny must have these future planes of peace—and when the time comes, we at Bell Aircraft will be doing our part not to let Johnny down. © Bell Aircraft Corporation, Buffalo, New York.

Airacraft for victory—
BRINGING PLANE TO THE PEACE
BELL *Aircraft*
PACEMAKER OF AVIATION PROGRESS

GET INTO PRODUCTION QUICKER WITH WHISTLER ADJUSTABLE DIES

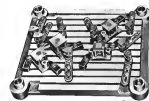
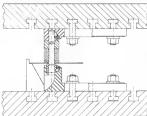
Adaptable to any type press for fast set-ups and quick change-overs on PERFORATING, NOTCHING and PIERCING operations.



Typical example of perforated and notched piece produced by a Whistler Adjustable Die Assembly.

ABSOLUTE PRECISION

Once locked into position, die and punch holders "stay put." Compact design offers minimum perforating centers of $\frac{1}{16}$ inch—more perforations in less operations. Full range of sizes for all types of work.



PUT U S PUT ON



COMPLETE INTERCHANGEABILITY

Machined to tolerances of .0002" all parts are interchangeable. Can be quickly rearranged for different set-ups—often without taking out of the press.

Side view showing construction detail of a 11-54, 17 or 18" Whistler Adjustable Perforating Punch and Die Assembly.



Whistler dies, tools and special machinery have been overcoming production problems—for over 25 years, in two wars—in the nation's most important factories.

Plywood "Cage" Nut

Designed by Bents Aircraft Mfg. Corp., New Canaan, Conn., to speed production of plywood aircraft and subassemblies, the Bents Self-Locking "Cage" Nut provides permanent fastenings for both plywood and plastic. In-



corporating the familiar wing style all-metal self-locking principle, this device may be applied from one side by one operator in a "blind" application of assembly. The nut has a locked nut seat which is "indicated" by appearance of the dependent tail. The basket portion then clamps the plywood to the self-locking grip so firmly that it easily withdraws, without forcing, the former applied when a tail is inserted by production methods. The clamping tail which sets the nut into the plywood is adjustable in varying directions by the use of wing arrangements. Thus, a single nut may be used with plywood or plastic from $\frac{1}{8}$ in. to $\frac{1}{2}$ in. thick.—AVIATION, August, 1942

CPTP Two-Way Radio

A three-purpose aircraft receiver that combines the standard range band of 250 to 430 kc., a "spot" frequency of 3100 kc. and a two-way outboard, is announced by Electronics Specialty Co., 3446 Glendale Ave., Los Angeles, Calif., aircraft units of Ranger aircraft radio equipment. Built for use in CPTP and Civil Air Patrol ships, Model 148 Receiver is light in weight and simple in operation.

The spot frequency picks up plane-to-plane communications from other planes in, out and provides a means of receiving the signals of other pilots for information from airport control tower, eliminating duplication of information received.

The set of handpiece, both of which have all incoming signals and two sets of microphones, provide a pilot-in-command interphone that automatically cuts and relays signals when the communication button on the microphone is pressed.

The entire receiver measures only 5 1/2x9x10 in., and weighs 4 1/2, 3 lb. It is driven in a superheterodyne, using

four tubes, and incorporating an isolation audio filter.

A matching coil transformer, Model 200, is the same size, has two tubes and is crystal controlled at the 3,600 kc. frequency. Both the receiver and transformer dry battery power supply is located in the cabinet and is easily isolated by removing four bolts and slipping the cabinet from the cabinet.—AVIATION, August, 1942

Auxiliary Pump

Designed so that it may be easily placed, disassembled and reassembled with a screw driver and pair of pliers, and incorporating plastic elements which release vital metal for other war needs, a new auxiliary hand pump has just been introduced by Bendix Aviation, Ltd., North Hollywood, Calif. The new design, which meets AN standards, is 16 percent lighter, and contains 145 less parts than previous models. It follows has been naturally increased.



The pump incorporates a simple piston double-acting arrangement with an integral cushion shock valve mounted at right angles to the main line. A chrome-plated steel piston and fitted with plastic bearings and bushings.



which incorporates within the minimum alloy bearing.


There are no threaded sections in the entire assembly, and the use of plastic bearings greatly reduces wear and scratching. Packing life is increased by approximately 30 percent. The new pump has completed a life test of 150,000 cycles and is now being specified for Air Corps equipment.—AVIATION, August, 1942

Pack's Presses

Tuned to wartime necessity, Pack's, a patent printing shop, developed by the Treadwell Press Co., Haverhill, Massachusetts, Chicago, Ill., machine—drummen to turn out for more work in a given time than ever before, some parts. Every printed mark or line on Pack's No. 124 Presses is done and sharp because the precision, white surface of this bearing steel takes print perfectly. It is tough, durable and will not dent or wear. Its glossy, step-down back in an added feature and its own transmission side speed to great production. Because of the high degree of transparency and the texture that results in ink-like density, from hand proof, you will get "jet-black-on-paper-white" positive prints as well as new, sharp, razor-and-rust. Materials from proof images on Presses. Pack's No. 124 is an automatic, increase which it permits the use of a 500 or harder pencil and produces the same dark down line as a 2B or 2H or ordinary tracing cloth. (Before made with a hard pencil will not smudge or rub off. Presses shows clearly and quickly with an ink gun or soft pencil and measures will not rub on the blue print. Available in 36 x 48 in. or in sheet widths of 36, 30 or 42 in. or in sheet



S. B. WHISTLER & SONS, Inc.
752-755 MILITARY ROAD
BUFFALO, NEW YORK



*For Production-For Maintenance-For Original Equipment
The Finest that Money Can Buy
Write for Complete Catalog*

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TOOLS

BONNEY FORGE & TOOL WORKS, ALLENTOWN, PA.
In Canada—Gray Bonney Tool Co., Ltd., Toronto, Ont.
Representatives—H. Paul & Co., New York, N. Y.
Distributed by Leading Jobbers Everywhere

used to fit your needs—Aviation, August, 1942.

43

Tack Rag

Known as a tack rag, especially prepared for professional handymen of the most particular type, made of a most excellent clove cloth, and chemically treated to remove the last trace of dirt and foreign particles from surfaces to be



finished, as the final operation before applying finishing materials. Made by Eckman Specialty Mfg. Co., Ltd., 85 E. Glenside St., Pasadena, Calif., the O-U-Tack Rag is available as to inform the individual user. It is used, it may be reduced by hanging in the open air, or increased by applying a small amount of heat—Aviation, August, 1942.

44

New Fuel Tank Sealer

Freemate Engineering Co., St. Louis, Mo., has announced the development of a new, break-on type, Fuel Tank Sealer, especially formulated to meet the extremely destructive effects of atomic fuels. The sealer is designed to seal integral tanks in airplanes and for mobile tanks and points in fuel storage tanks in airplanes and fuel storage tanks. The product is applied with a brush, or it can be forced on with a regular type of hand operated caulking gun. It will not become soft or slump at temperatures up to 200 deg. F. yet will remain flexible and plastic at minus 90 deg. F. Tests have shown that when brushed on the inside of metal containers with 120 in. holes in bottom and sides, the compound will seal the holes and remain tight and impervious when the container is filled with atomic fuel. Under each condition the sealer shows no effects from the atomic fuel, no softening and no leakage through the holes so tested—Aviation, August, 1942.



Creators and Makers of
ACCURATE RESISTORS—SWITCHES—SPECIAL EQUIPMENT AND
SPECIAL MEASURING APPARATUS FOR PRODUCTION AND
ROUTINE TESTING OF ELECTRICAL EQUIPMENT ON MILITARY AIR-
CRAFT... SHIPS... VEHICLES... ARMAMENT... AND WEAPONS



True... our present activities are mostly high priority War-Time Work... yet, we have recently greatly enlarged our Manufacturing facilities... and perhaps we could take care of your needs. Why not submit your problems to us NOW... and we will do our best to give you an answer. Please address Dept. No. 8.



HALLCROSS MFG. CO.
COLLINGDALE, PENNA.



MOLYBDENUM ENLISTS FOR THE DURATION

The enormous increase in requirements of molybdenum has necessitated the War Production Board Order M-110, placing molybdenum consumption under allocation control...Our metallurgical research staff is fully engaged in war work. At our mine, mill and converting plant, every effort is being made towards maximum production.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS, MOLYBDIC OXIDE-BRIGHTENED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Molybdenum Company
500 Fifth Avenue • New York City

Spark Plug Test Unit

New, completely self-contained spark plug test unit, which produces their own electrical current supply and can be used anywhere in the field, have been introduced by **Pacific Automotive Division of General Motors**. As a result, the units permit service and testing, make easier to operate line of these tests, in checking ignition troubles. In addition to airplane engine work, the units are an important tool in test, maintenance and for gasoline-powered engine boats and aircraft landers. The Pacific Automotive units are



equipped with a pressure type spark plug tester. A spark-testing hand pump supplies the necessary pressure. In addition to complete field testing equipment, the units can also be supplied with a gap resetting tool. This portable spark plugs, which are found to be satisfactory electrically, to be set to proper gap clearance and returned to the engine for further service. Units are completely wired, ready for use and are mounted in strong boxes equipped with carrying handles.—**AVIATION**, August, 1942

Part Marker

The motor-driven No. 48 marking machine manufactured by the **Aero-Mark Corporation**, 5133 Macmillan St., Oakland, N. C., is designed for the marking of tubular parts, valves, pipes, flanges, coupling devices and other small parts. Parts are placed on a



rotating stand on hand and the rotating disc against the work, when the part is automatically marked. Marking speed can be adjusted to desired speed and with small parts, such as those shown in the illustration, a speed of 30 pieces per minute has been obtained. Turned in a standard 130-220 air motor, the machine can be attached on a bench and, since there is no oil to be an appreciable factor in selection it can be used in office or laboratory without heating down.—**AVIATION**, August, 1942

New Relay

A new five pole relay, designated **CE274-5008K**, has been added to the line of **General Electric Co.** (Schenectady, N. Y.) control devices for control applications. Features of the new relay are: light weight, permanence of position and assurance of operation under severe vibration conditions, and operation at high speeds at rated current. The relay has a maximum continuous current rating of 10 amp. at 11 or 24 v., d.c., and a maximum make or break current rating of 50 amp. at 11 or 24 v., d.c. The normally open contacts have a tip travel of 1/16 in.



Coil ratings are 1.50. The relay weighs 280 g. Dimensions are: length, 2 1/2 in.; width, 1 5/32 in.; and height, 1 1/16 in.—**AVIATION**, August, 1942

Portable Fluorescent Light

A new, fluorescent, portable light that is safe to use in places where any combustible gas may accumulate and small enough to be readily used in places inaccessible to most maintenance lights, is announced by the **Ray-Ray Products Co.**, 902 Ray Drive Ave., South Pasadena, Calif. It was developed for the Lockheed Aircraft Corp. for both indoor and outdoor assembly work in confined places in the P-38 Lightning fighter. Known in a code of maintenance



"Lodis" methyl methacrylate resin, the red burning fluorescent tube gives off optimum light, thus eliminating shadows in a limited working area.—**AVIATION**, August, 1942

Variable Speed Transmission

Kearney Rulley Co., Columbus, Ind., now offers a Special Design of its standard design Variable Speed Transmission, with built-in chain reduction gear with the output shaft in exact alignment with the input shaft. Output speeds may be increased or decreased as compared to the variable speed shaft of the transmission. Variable, within



prearranged limits, by turning the speed control handle, the chain drive operates in a both of all.—**AVIATION**, August, 1942

WHEN THE SPOTLIGHT IS ON LOW MAINTENANCE!

Here's Something to Consider



Today's long hours and triple-shift production schedules throw the spotlight on maintenance—for greater dependability of equipment is a wartime must. But with the Gardner-Denver Company, low maintenance has always been a steadfast objective in air compressor manufacture. It is to this end that Gardner-Denver manufacturing skill and leadership are directed. It is for this reason that Gardner-Denver compressors have established such remarkable maintenance records for installation in every part of the country. The typical user reports below show how two Gardner-Denver compressors are meeting the test of maintenance.

Gardner-Denver Class "HA" Two-Stage Horizontal Air Compressor



For heavy duty installation against such continuous demands for maintenance, Compressor runs over 200,000 hours for duplicate major part service.

Our "HA" Compressor has given 24-hour-a-day service for 4 years—has required only routine valve dressing. This rotor valve bearings have never been touched.

"Operating between 15 and 14 hours daily, two "HA" Compressors have been installed over a year ago. No production time has been lost, nor has there been any maintenance cost."

Gardner-Denver Class "RX" Single-Stage Horizontal Air Compressor



A single-stage ball compressor with remarkably low horsepower and maintenance. Supplies 1000 CFM to 2000 cubic feet displacement per minute.

During 6000 hours of steady operation, no Gardner-Denver "RX" Compressor has required an replacement and very little maintenance. No lost time has been charged to this machine.

In a recent six-month period, our "RX" Compressor has been operating day and night. With a total of 3,700 hours in its credit, it has caused no lost production time whatsoever. The compressor operates an average of 15½ hrs for 30 hours a day and 10½ hrs for the remaining 9 hours."

For complete information on Gardner-Denver "HA" and "RX" Single-Stage Air Compressors, write Gardner-Denver Company, Quincy, Illinois.

GARDNER-DENVER

Since 1859

AVIATION August 1942

DoAll

WORKS FOR Lockheed



Our hats are off to Lockheed's new, tough-sinewed interceptor Lightning, also to their sturdy commerce convoy ship, Hudson—both rolling off the lines in record time.

DoAlls installed in various departments of the modern Lockheed plants are doing more than their bit. Illustration shows operator cutting a metal jig—one of many special die-cutting and regular production jobs for which the DoAll is famous.

★★★ SAVES TONS OF METAL >>>

Right now, every ounce of metal and alloy is vital, especially such high priced ones going into plane production like magnesium, synthano, aluminum, copper, stainless steels, etc.

Unlike some other machine tools which reduce waste metals to tangled chips and heaps of filings, the wonder machine DoAll cuts as evenly and smoothly as a keen-edge razor, leaving only a fine, soft dust and unused portions in large places from which smaller parts can be made.

Five models to choose from. Throat capacities 16" to 60". Low priced from \$1000 to \$5000, complete with motors. Let a factory trained man call at your plant to show you how to save time, metal and money. It's easy with the DoAll.

NEW BOOK—"DoAll on Production" shows DoAll at work in leading plants everywhere. An interesting story told in pictures. Send for copy.

Airplane Ambulances



One of the best of mobile machine shops of the U.S. Air Corps for assembling combat planes in the field. Damaged planes can be reconstructed and repaired right in the spot. Each unit carries a DoAll Center Machine as part of its equipment.



CONTINENTAL MACHINES, INC.

1305 SOUTH WASHINGTON AVE. • MINNEAPOLIS, MINNESOTA

Associated with the DoAll Company, Des Plaines, Illinois.
Manufacturers of Road Saws and Road Files for DoAll Center Machines



Plumb Bob

Steel is so perfectly adaptable to adjustment and retooling, as well as other operations where precision alignment is necessary, is the new Precision Plumb Bob, announced by Aero Tool Co., 221 W. Olive Ave., Burbank, Calif. A special feature is a novel use of photographic analysis, ensuring a true and constant, sharp point at practically no replacement cost. The profile is held by a welder's gas torch at the supporting end. The hole for the extension wire is held to exact size and is absolutely centered with the in-

struments from the bottom of the shaft. In the patented model, the supporting pin is mounted either in the cover or the bottom. Its small size weighs the weight to exact specifications in which the standard model cannot be used as it is applicable to built, control, gun turret and photographic use. The specifications are as follows: Size—



1 1/2x1 1/2x7/16 in.; weight—7 1/2 oz. per—940 in., rotating movement—940 in.; rotating pressure—3 1/2 in. or less, ratings—250 v. 5 amp. A.S. and 115 v. 15 amp. A.C.—Aviation, August, 1942.

52

Hydraulic Welding Table

A hydraulically operated elevating welding table with revolving top has been developed by the Lepo-Fargnoli Corp., Green, N. Y. While it would not exactly be called a welding positioner, it is used to save the expense in extra fixtures as well as more expensive pieces of equipment. The operator simply lays the work at the most convenient welding height by means of a hand-operated hydraulic pump. Work can be moved to the most convenient position as the table revolves as well as elevates. Models are in a capacity of 5,000 lb., platform size 30x30 in., lowered height 30 in., elevated height 60 in. Table is portable although it is mounted on a four-hair rather than on casters.—Aviation, August, 1942.



driving point. The upper part of the bob is threaded into the lower. These bearing surfaces between these parts hold them absolutely concentric. Thus by rotating one part upon the other it is possible to move or lower the indicating point one 1/2 in. without losing concentricity. This adjustment feature is said to be particularly important in the shaping of gunights and other precision instruments.—Aviation, August, 1942.

51

Aeromap Midget Switch

Aero Electric Co., 2613 Folsom Rd., Cleveland, Ohio, has just placed the new Midget Switch on the market. It is used to release all the features of the standard Aeromap switch, including the principle of the rolling spring, which keeps the blade from one position to another. The rolling spring mechanism adds for very low parts and very low operating strain, thus extending service life of the switch. In the open model shown here, the rotating pin



53

Stop Counterlock

An improved stop counterlock, with ball thrust bearing to take up slack, is announced by Aircraft Tools Inc., 750 East Gage Ave., Los Angeles, Calif., manufacturers of Aircraft Tools. The drive shaft runs in a bronze sleeve, which with the thrust bearing insures complete accuracy and long life.



life. The new counterlocks are hand adjusted for fast and easy cutting, with the desired adjustment readily locked. Cutters are made of high speed tool steel and have highly polished flutes, accurately ground to correct cutting angle. They are available in 7/16 in. and 7/8 in. outer diam., from 7/8 to 1 1/2 in.—Aviation, August, 1942.

54

New Welding Tips

Air Reduction, 46 E. 42nd St., New York, N. Y., has added two new oxyacetylene flame cutting tips. No. 108, for close quarter work, is built in an offset shape to permit cutting along a line 21/32 in. from vertical outside of the torch head or handle. It has offset flat sides, with two pre-set flutes, and is suitable for hand or machine operations. Style 109, a straight tip with one pre-set flute, is a companion to Style 108.—Aviation, August, 1942.



SOUTH BEND TURRET LATHES

For Efficient Production of Duplicate Parts

THE No. 518 South Bend Turret Lathe is a dependable tool for the efficient production of duplicate parts. It has the precision for setting, close-tolerance operation, single pass, and the rigidity required for producing a fine finish.

Twelve speeds, ranging from 16 to 800 R.P.M. are available. A two-speed motor with convenient lever control permits quick change from high to low speed for turning and tapping operations. Smooth operation for precision turning and boring operations in high speed is achieved by direct belt drive to the spindle. Slow speeds for heavy cuts on large diameters are derived through gears.

Bar work, up to 1 1/2" round can be passed through the collet. The spindle hole has a capacity for stock up to 1 3/4" in diam-

eter when a universal chuck is used. Maximum capacity for chucking operations is 6 1/2" using one of the universal odd-size cross slide and 16 1/4" using over the bed ways.

The cross-type turret has power feed and hand feed, with its divided adjustable feed trip and stop for each of the six turret faces. The turret head indexes automatically on the return stroke of the turret slide.

The universal carriage has power cross feeds and power longitudinal feeds, also lead screw and splined feeds for cutting accurate screw threads. Flange cross slide fitted with front and back tool blocks is standard equipment. A 4-way turret tool block can be supplied to order. Write for a catalog and the name of our dealer nearest you.



SOUTH BEND LATHE WORKS

Dept. 180

SOUTH BEND, INDIANA, U.S.A.

LATHE BUILDERS FOR 35 YEARS



On Your Sub-Contracts for Fabricated Metal Parts

Like Uncle Sam's highly efficient Engineers, the Lyon War Products Committee works as a well balanced team to give your fabricated metal part problems fast and effective action. This committee—representing all major departments—has more than a year's specialized experience in determining how Lyon can serve you, and how fast your needs can be met.

Supporting this War Products Committee is a nation-wide crew of field men specially trained to gather all pertinent facts, modern plants equipped to handle volume production, and design engineers, plant executives and workmen long skilled in producing quality sheet metal products of all kinds. Modern machinery and completely equipped toolrooms enable us to handle all operations—including marking and mistreating of dies and jigs—in our own plants.

So, if you have war products or parts that require fabrication of No. 8 to No. 30 gauge metal, turn to Lyon for action. Write for brochure, "Confidence in War Production," describing Lyon facilities in detail.

LYON METAL PRODUCTS, INCORPORATED

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Sales and District Offices Maintained by Independent Representatives in All Principal Cities

LYON METAL PRODUCTS, INCORPORATED

THIS BROCHURE will help enable any producer of War Materials to determine where Lyon facilities and experience help him accelerate production. A copy is yours for the asking.



They learn by doing

Subcontractor's representatives don overalls in the Curtis-Wright plants and use their hands to do the jobs they will direct when they return to their own factories.

By E. M. WORTHINGTON

Industrial Contracting & Planning Section, Curtis-Wright Corporation

CURTIS-WRIGHT has found a solution for the subcontractor selection problem that has halved the time required to impart the know-how of aircraft manufacturing to the makers of hundreds of new military orders to the field of aviation production. Reduced to its simplest terms, the system involves a two to five month period of intensive training for the manufacturing organizations and the follow-up by Curt-Wright men after the trainees has gone home to set up production in his own plant.

The training course at Curt-Wright goes on for a long time. After a

quick indoctrination, and a few lectures by plant executives, the trainee rolls up his sleeves and reports for duty to the foreman charged with production of the part to be subcontracted. Before he leaves the plant, the trainee has learned how to make the part with his own hands.

That perhaps the greatest value in the training is received at the night session when his group gathers for a discussion of the day's progress. Here, made voluminous notes of his observations and operations, each man tells what he saw and did. Differences of opinion are

(Continued on next page)



Two foremen representing a large supplier to the automotive industry now in training at a Curtis-Wright plant in the subcontracting program learn aircraft techniques firsthand. William Moore, right, is assisting Glenn die Smith while Benjamin Parker uses a high-speed drill.

LYON

Shop Equipment
For War Industries

● Results in plant after plant prove these Lyon Steel Shop Equipment items contribute to faster output. They reduce fire, sabotage and water damage . . . save men and machine hours by preventing the misplacing and loss of tools and injury caused by splintered and worn tooling.



LYON Service

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DEPEND
ON
DIX**



DIX AVIATION TYPE UNIVERSAL JOINTS

Control of the A-1's are only to be accomplished by perfect control of the universal joint. Dependability is derived from the strength, simplicity, economy and reliability. Manufactured by Ray, Henry and Allen Corp. specifications ready to install, at the price one special requires.

PRECISION MADE

DIX Aviation Type Universal Joints are made of special high quality alloy steel hardened and ground to infinite accuracy for perfect action and longer wear.

These products stand to save you money. Write for catalog to receive and technical data.



LEFT: Three men representatives of a large submarine supply "house" working with Curtiss-Wright engineers on a flow rig. **Joseph Fawcett and Anthony Thomas** operate flow rig while **Clas Ben Jorgensen** stands at the head with a high speed dial. **RIGHT:** E. J. Haglin, a radio submarine representative, stands at his training by operating a control room dial on a simulator.

DIX MANUFACTURING COMPANY
INCORPORATED
1000 BROADWAY
NEW YORK 10, N.Y.

**We deliver
the goods!**



DOWEL PINS IN STOCK FOR IMMEDIATE SHIPMENT

You, for instance, need hardened and ground Dowel Pins are carried in stock for your convenience. Ground to tolerance of plus or minus .0005". Standard pins ground .0002" over final diameter; expensive pins ground .001" over final diameter. In 20 lengths from 1/8" to 6". In 11 diameters, from 1/16" to 1".

We have all your requirements for all the Nation's supplies, including a complete line of springs in three standard types, and the amazing illustrated Dicks that enable you to do all the hard work without sweating.

Write today for Illustrated Catalog.

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WHEN MINUTES MEAN VICTORY

These are action times. All-out production. Maximum speed means dependable Williams' Wrenches. For practically every standard bolt and nut in aeroplane, truck, tank or battleship there's a Williams' Wrench to do the job. Be fully acquainted with your Williams' stock. See that your men know the correct tool for each particular job. You'll find it goes a long way toward reaching our goal When Minutes Mean Victory.

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positive frequently occur and these are not sought the next day by re-visiting the particular department. Minutes of the meetings are recorded and all notes transcribed for the benefit and use of the interested parties. The amount of material gathered, much of which was previously exclusive to Curtiss-Wright, is staggering. But the kind of policy in these studies suggests two possible and proves that the small as well as the large manufacturers can master difficult aircraft production methods.

The enthusiasm of the men who take the course is one of the best measures of its success. After a full day's working in the plant, these men, night after night, return to their hotel to gather in a special working room maintained by Curtiss to talk over the day's events and swap notes on what they have learned. An average of two or more hours every night is spent in these "after school" meetings. Without exception, the men who have finished the Curtiss training have returned to their sponsoring companies with glowing comments and a spirit of enthusiasm for building the subcontracting job.

No exception, in fact, was the president of one of the large subcontracting firms by the enthusiasm of the men at his organization who had taken the Curtiss course that he resolved to take all vestiges of it personally. The enthusiasm of this president for his "learning by doing" training at Curtiss, has since then resulted that of any of his men who took the work.

With the concentrated step in training men upon their organization in its production methods, Curtiss-Wright feels that it is making a major contribution toward speeding the war effort.

The number of subcontracting firms joining their members to the Curtiss-Wright school are not be missed for subcontracting, but they strongly represent a wide assortment of fields, including manufacturers of pipes, tanks, valves, flanges, tank attachments, rubber products and subassemblies.

Each subcontractor as arrived to deal a key man, or men, who will be placed in supervisory capacities upon returning to their own plants. Upon arrival at the Curtiss plant, these men are put through a preliminary employee training course. They are then actually put on the production line and allowed to perform that part of the production process to be undertaken by their own company. The trainees are given access to all phases of the Curtiss operation bearing on the particular item or process in which they are interested, including the engineering, planning, design, tool and fixture design, heat treating, material laboratory, and other departments. Manuals and specifications that lay out the standards of Curtiss-Wright are supplied to trainees.

The area covering this training remains on their own company's pay roll, and Curtiss-Wright is relieved of any responsibility for these men by agreement not to work on weapons.

(Turn to page 122)



The Birdmen's Perch

THE NAMES ARE STILL rolling in for *Only Birds*.

In case you came late—the ad-matted feather duster hopped onto the page last month and refused to go away. We gave her a temporary name of "Only Bird" and asked the Perch Pilots for a better one. We've got some ideas, too.



Labelled...
Strut Sm...
Perchard...
Tun...
Tell you what—we'll give an original drawing of the gooseback to the bird who gives her the best name.

We mean you Perch Pilots on foreign soil, too. Because if you need a better name than the one we pick, say this within the next six months, we'll reward the gooseback and send YOU a drawing. O.K.?

Major Al Williams

aka, "Famous Wing Tip"
Gulf Aviation Products Manager, Gulf City, Oklahoma, Ok.

BRAINWISER

Two placebos played a 730 side NC reg. Because of engine trouble, we were unable to get off until the other was 11 all the way to the destination. The

late season said G.A.G. (however, not you able to fly) inadvertently rule of the other pilot. Who got there first? You wish and we'll answer.



ALLY FORGE

A place engine trouble is now facing cylinder heads, control of casting them.

Forging cylinders up to 1 1/2 in. of necessary weight per cylinder. And such amazing pound of the "closed-up" head does an improved mass alloy cast job, increasing weight by up to 10%.

This forging technique for making cylinder heads might be compared to Gulf's Alloy technique for making Gulfpide Bush engines over all methods.

Gulf's special Alloy Process produces a more weight in the form of casted metal and design-former. Thus the necessary "closed-up" Gulfpide does to improve, more efficient job of reducing your engine's increasing on performance.



WHOPPER
Dear Major:
Don't put this in the Whopper column—
—it's true!

This ad was dropped out last month, after the Gulf City News-Record, Inc. It was placed together from lots of en-

times found along the New Brunswick coast, and the undamaged film from his camera gun.

Dear had just visited his friend Mark H. (Gulf Aviation Co. of course) and was an sponsored training over to scheduled course scheduled day. He must have cranked his thrusters and gone into a little time. Halfway through the turn, P.O. Quick saw what he thought was the yellow tail of a jet aircraft. He let go with all guns (just) and watched the yellow tail disappear.



While we normally travel at 750 on 14 barrels (and G. A. G.) Elmer must have for recorded the machine's acceleration when he cranked the thrusters. Possibly even by chance. The Way gave a mighty nose, turned right, and went home out of his own will!

L. A. C. Woodhead Jr.
L. A. C. Johnson Jr.
J. B. A. R. S.
Houston, W. R., Canada

Gulf Oil Corporation and Gulf Refining Company... makers of



Oil is ammunition—Oil is wisdom



THE OATH OF A FREE-MAN

I (A.B.) being by Gods providence, an Inhabitant, and Freeman, within the Jurisdiction of this Commonwealth: do freely acknowledge my self to be subject to the Government thereof: And therefore do here swear by the great and dreadful Name of the Ever-living God, that I will be true and faithful to the same, and will accordingly yield assistance & support thereunto, with my person and estate, as in equity I am bound; and will also truly endeavor to maintain and preserve all the liberties and privileges thereof, submitting my self to the wholesome Lawes & Orders made and established by the same.

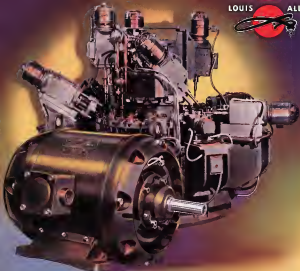
And further, that I will not plot or practice any evil against it, or consent to any that shall so do; but will timely discover and reveal the same to lawful Authority now here established, for the speedy preventing thereof. & Moreover, I do solemnly bind my self in the sight of God, that when I shall be called to give my voice touching any such matter of this State, in which Freeman are to deal, I will give my vote and suffrage as I shall judge in mine own conscience may best conduce and tend to the publick weal of the body, without respect of persons, or favour of any man. So help me God in the Lord Jesus Christ.

This Oath of a Free Man was the first printed form prepared by the Colonial Secretary at Philadelphia.

GULF AVIATION PRODUCTS

Oil is ammunition—Oil is wisdom

—A 730 RESIDENT IN YOUR TANK WHEN YOU LEAVE THE PUMP—
—A LAST WARNING AND STAY—
—LEAVE ROOM FOR GULF OF A "BURNER" OF GULF AVIATION GASOLINE.



Making Good Machinery Better!

For over 40 years we have been developing special motors for special jobs — working with the designing engineers of many of the nation's leading machinery manufacturers — helping make good machinery better.

The motor illustrated is our TOTALLY ENCLOSED FAN COOLED Dust Proof motor — which is available in a wide range of electrical and mechanical modifications.

THE LOUIS ALLIS CO., MILWAUKEE, WISCONSIN

No matter what your electric motor problem or requirement may be, we invite your inquiry — and assure you that your needs will receive our prompt and careful attention in every way.



•THREE, FIVE SEVENTEEN AGO, military gliding was just old hat. Now it's the talk of every town. Hundreds of young men who live and dream of war have had a laydown in the basement since 1918.

We hate to think what may happen to some gliders and their occupants during the war, but after the war it's going to be fun for the operator, the pilot, the passenger, and the Aviation Writers Association.

And as everybody has settled down to the prospect of an eleven or an eighteen cent movie reduced three per cent a Saturday night by a Saturday night, here we are confronted with what was thought to be a thing of the past.

We hope the glider industry's publicity men will start right now looking up a better name for their machines. On it is a machine. Certainly "glider" won't do. It sounds snooty enough, but not impressive, not dignified enough for the high society people on Manhattan and Beacon Hill. There is the idea of the "air" but about it, so no package of the right for sale at the amusement park.

It something is not done about a better name for gliders, we predict that, even the recreation period, you will have the no motion picture set in the Little Old Lady. "Take-dag number six, modern-day number six." Or if it doesn't turn out to be a "thing" it will be a "glider." You see, you have used a word for it and the Glider never had one.

If you're still interested in a great deal you at my town lived in the future, just watch that Little Old Lady. She indicates here and her on a trip to Children because her last her and are not of having her around. And here she is, about half way there in October. When the odds and "dag number six" she demands to be "no." "No, the airplane, didn't stop her, then last year. By this time she is found to two right a mile with a person who for drinking eggs, and the air station are not like bus stations. Don't be so, we are just making this up.

She gets into the glider with 80 silver people and into down in a seat, there come from the window. So some has also put her packages arranged on her lap than a "man-made" plane runs about 30 feet overhead, lands into No. 80 and goes on a landing a little out of audience. They are all told to it except the Little Old Lady who moves her head back a bit.

This train has four other gliders and one of them is shifting along just ahead

and to shortened. One third put on her spectacles and one 300 ft on it and goes to wandering, and she made the seat as the blue suit and the gold belt to be come by and she does this thing go to Sea Lion Obispo, and the guy says "Go."

Now's not it happen in real time. By law you can put the glider here and make three let you off right there, as well tell the next station. But first gliders only go to one place. This one was going to Chicago. The Old Lady was told before the other passengers she didn't want to go to Chicago (looking as if she might try to go head over head on the low line to the locomotive) when the pilot said it was better. The low line go and stopped like a string of comets.



on the down plane until it is. The train is supposed to be stopped, and the glider goes down to Chicago with four poor little old lady.

But that was just a day each glider for the women people. That all you wanted. After that, as they started to the deeper job, with the white beam suit and the no color and the 8000 north-west. There is no vibration. It's much as a mountain ride. There's no rain, only a soft spring, and so you lie in bed with your eyes of Good Handwriting. You are here the leader someone reports and carrying his best come, and in this your mind off it, you can make up some more about the letters of glider.



"The police's complaint is OK but don't you think Niagara is stopping it is Little Old Lady?"

Aircraft Production and Incentives

AUTHORITATIVE SOURCES are unanimous in lauding the outstanding record of aircraft production being achieved in this country. No longer is there any doubt that the new financial goals of \$6,000 planes this year and 150,000 for 1945, will be met.

It is most remarkable that this stupendous production schedule is being achieved under the same conditions of our life-time economy, maintenance of tax and wage policies, recurrent "peace" reports, absence of post-war loans and other confusing elements which are bound to accompany a production effort as stupendous as that assumed by the aircraft industry.

Fortunately, it is the actual production of planes that counts. The accompanying circumstances, while definitely not ideal, seem to be tolerated as long as ultimate victory is not endangered.

The President's statement that about 4,000 planes were built in May, 1944, indicates an annual production rate of at least 48,000. When it is realized that back in May, 1940, the aircraft industry was producing planes at the annual rate of 1,500, some conception is afforded as to the tremendous gains attained by the industry. A better than 1,600 percent increase in production as during a two-year period is a most significant fact.

It is particularly significant that it has been the established aircraft builders who have thus far carried the burden and have been primarily responsible for the great output. The manufacturing industry is faced of solving the part in the aircraft production drive, but its staff is still largely on order and may not build large units this year.

The latest public criticism leveled at the aircraft industry is contained in the report recently filed by the House Military Affairs Committee. The report also faulted the industry for its "inertness" towards extravagance and dissipation for money spent is less than the risk rather than the economies. All sorts of detailed facts are then enumerated, but then for an individual company are noted. It is possible that some exist where some of the economies mentioned, such as standardization and similar expenditures, are prevalent. It appears ill-considered, however, to condemn an entire industry because of isolated practices. Instead of general charges, specific cases should be cited and known where where shown are present. This would seem to be the correct approach and much more likely

By SELIG ALTSCHUL

recruitment would be opened the end of the industry.

More importantly, constructive suggestions and recommendations of alternate procedures appear in order rather than outlining the report with a general criticism of the industry. Only last month, this department pointed out that earlier present procurement methods, "no matter whatsoever is present to promote more efficient and economical operations." It was further noted that with the profit motive gone, resistance to increased expenses is doubtless lessened.

It is small wonder that ideas generated by the House Military Affairs Committee have been allowed to develop. The production figures themselves bespeak the patriotism present in the aircraft industry. It takes a modern of public and an incentive, however, to assure the most efficient output. American industrial progress has obtained its present high state of development because of standing the line, sometimes even present revealing those who were able to advance new and better ideas. However, human nature and the basic law of economics work back and forth, the most when spurred on by the promise of some reward. At a general rule, society as a whole then becomes a major beneficiary. Any improved manufacturing or transportation procedure, inevitably reduces production costs, and if passed on to the ultimate consumer, the public gains.

This simple economic theory applies to the aircraft group as well as to any other industrial enterprise. The retention of an incentive in the aircraft industry is vitally important if production costs are to be lowered and more value per dollar expended is to be realized. The individual companies, the government, and the taxpayer will thus all benefit. And above all, a direct result will be constantly improving fighting craft for the armed force.

No company should count on profit from the war program. In fact, taxes and other profit restrictions being what they are, excessive gains are such impossible. Furthermore, more stringent enforcement of Treasury Division 5008 may be expected in which many of the shows that currently prevail. But nowhere, a procedure must be found so that all possible incentives are not constantly stifled. In the manner, the latest efficiency at the latest possible

cost may be obtained in the production drive.

From still another House committee, some reports of a more meaningful nature. The House Appropriations Committee is releasing the hearings on the record \$425 billion supply bill for the fiscal year beginning July 1, and shows that aviation is getting first priority in the development of efforts and defense weapons. The largest single item—\$113.3 billion—is for aviation equipment, including 23,550 planes.

Mr. Dies, Arnold is quoted as saying that aircraft factories under contract to the Army will produce in 1942 and 1943 at least 180,000 planes, the Army's share of President Roosevelt's 180,000 plane goal for the two years. This is a definite statement as has yet been noted by an authoritative source on the aircraft procurement program.

Particularly noteworthy was the Committee's statement that voluntary restraints by war contractors and recapitalization of some factories produced large savings. At this date, potential savings approximately \$1,125 million, the report stated. Then comes the significant comment: "This reflects the aid of the War Department to maintain profits in the aircraft industry and it reflects the high type of new economy spirit which we see to dependent for production of airplanes." Of course, this refers to the one-of-a-kind nature, but with aviation building large, it is difficult to see why the aircraft builders must cut themselves in for a share of the new production. At least it is a laudible intention that a powerful House committee has given official guarantee to the necessity of maintaining profits at "fair levels."

Once again, a seemingly unrelated event on another unrelated front may seem away over to directly affect the aircraft group. A three-man War Labor Board panel is reported as recommending voluntary wage increases and a maintenance-of-earnings arrangement for the employees of four major "Little Steel" companies. The fact WLB is expected to serve as final arbiter in this matter in the near future. Any restriction imposed by the WLB will not only extend to the entire steel industry but will necessarily reach over to the aircraft group. It is difficult to relate any broad wage agreement to an industry. This is particularly true with war war industries becoming concentrated in more ways than one.

(There is page 106)

Pump Bob



This Aero Tool Precision Pump Bob is designed for precision aligning operations, adjustment and rig installation.

A feature of this Pump Bob is the freedom of the upper part into the lower, three bearing surfaces between the parts held them absolutely concentric. Rotating one part upon the other rotates or lowers the indicating point more than 1/2" without losing concentricity.

To move a constantly sharp replaceable point, a

workman's pin check accommodates photoglyph needles at the indicating end.

With the introduction of this Precision Pump Bob, Aero Tool Company opens wide its line of fine production tools for war industries. Included in the line are a pinball tool and dynamometer, Monometer Step Counter, Countersinks and Countersink Cutters, Hollow Mills, Saw Bars, Bushings and Facing Indicators. Send today for your free literature, please! for the complete new illustrated 28-page 1942-43 catalog.

AERO TOOL CO.
SUPPORTED AVIATION TOOLS

AERO TOOL COMPANY • 233 WEST OLIVE AVENUE • BURBANK, CALIFORNIA



"SWIR NOSE". . . In this war it takes hell to win.

The massive wings of the Republic P-47 Thunderbolt is a symbol of fighting brawn and rocket speed . . . of terror to Nazi and Jap . . . Republic Aviation Corporation, Farmingdale, Long Island, New York

REPUBLIC AVIATION



Report from the British Airfront



The Lockheed HUDSON enters with the Spitfire as one of the greatest air achievements of the war.

Mr. Cave continues his observations of American aircraft now in service in the European battle zones and discusses new military airplane and engine developments.

By MYLES V. CAVE
Warrent's Aerial Correspondent

INSPITE THE INCREASED TEMPTATION of aerial fighting in Europe, most information regarding airplane performance has been generally withheld. Official announcements continue to give names of airplanes participating in big scale operations, but additional releases to allow any new state of immediate technical value to filter through the Red web.

The huge scope of aerial warfare has given great political impetus to Navy planes operating from aircraft carriers. The United States, at the commencement of the World War, led the world in Navy fighters and a number of these excellent craft are now operating with the British fleet. The first serious ones appeared the Grumman Martlet very briefly, as do the Navy technicians. The experts are a profile in experience with the Spitfire which has a better performance, better maneuverability, and much lighter landing than British Bess, Glass and Fulmar.

The Atlas and Bear have served the purpose, but their lack of speed and maneuverability, due to the Navy's high specification requirements, have

made them a comparatively easy target even over the most safe waters. There is a good deal of battle going on here with new Navy airplanes, and two new designs will soon be seen. Their performance may be reduced high as they will be powered by a new type, and more powerful engine.

Land Fighters

In the air-to-air battle, American's newest fighters, the Lockheed Lightning, North American Mustang and Bell Aircraft were to have been kept in the background so far, at least in British operations. In fact, as can be determined these planes have not been used in action in the Western zone, but they are here in numbers and are still being brought to be in the last shape to take part in the very serious fighting conditions to come.

The Lightning acts as a whole as three machines here are still very small and most seem ill-fitted and problems will have to be worked out. Some reasonable differences with the Mustang were experienced, but these have been overcome and a couple of weeks ago I saw four long enough runs of these planes with speed, and I was told that the "two was doing together" here, certainly, the first four at this factory rate this American fighter may light,

and judging from his flying demonstration of its maneuverability, coupled with long, low power, it will certainly prove to be another headache for Hitler, Goebbels and Go.

The Curtiss Wright Kittyhawk and Corsair have had up reasonable performance records on the Western front. The British have also showed their preference for the Mustang. It is almost of their design, faster, more maneuverable and more heavily armed. They have used it with great effect in destroying enemy ground formations as well as bombers and dive bombers. Destroying Luftwaffe fighter pilots is another job they seem to be doing. Their pace doesn't look like any other engine.

This superb English fighter has a most reputation for taking out landing characteristics on temporary airfields, and it looks like the Mustang will start something when he leads a fight with a heavy landing gear. In an opinion this feature has come to stay for this type as a plane.

Several criticisms will be better attainable performance which shows that they have no turbo-propellers. Although it, while they say that the engine room is cramped as they have to pick suitable one lives. Several aircraft companies claim the Mustang has better visibility generally than any fighter in service.

SEND FOR THIS FOLDER ON PLYWOOD FINISHES

TUF-ON

the Plywood Finish that came out of a Test Tube

The test tube in which TUF-ON was developed, was made from a ply of the same material, and was finished with the same finish. The test tube in which TUF-ON was developed, was made from a ply of the same material, and was finished with the same finish.

**The Industrial Research Division
WIFE-ON CORPORATION
105 Hudson Street, New York, N. Y.**

It is important to the fabricator of plywood for airplane construction that he use the "surface treatment" that is especially formulated for his own method of application and drying facilities. The folder "Out of a Test Tube" has been issued to aid him in the selection of the TUF-ON Finish that will give him the most satisfactory results. Sending for this folder may be the first step in producing a more durable finish in shorter time.

TUF-ON FINISHES INCLUDE

A full line of Exterior and Interior Finishes for all and finish drying in atmosphere, dry and film, and their undercoatings and stain, clear and stain filling compounds.

many thousands of miles from home. They have taken heavy punishment, but always do their job and get home safely.

Now comes the amphibious Catfish with which attacking submarines into the hull directly below the wings. I do not know to what purpose these amphibians will be put, but it is plain that the scope of the Catfish operation will be more than doubled. The Catfish is a hybrid, ship to handle them for destruction, though the latter has larger eyes, antennae, and fins.

Another new German plane supposed to be operating on the Atlantic from the new Bremerhaven modern launch on the M.E. 218. This was to be an enlarged version of the M.E. 210 which has not been the one limited period success in flight as some experts figured it was going to be. No details are available regarding the motor in the new German plane, but it would appear that the latest and more powerful Mercedes Benz is installed, which gives the airplane a bomb load of around 4,000 lb., with a maximum speed of 350 mph.

As for engines, these weak and inert trouble were with the Vickers, particularly in connection with the emergency drive mechanism. This was probably due to misalignment of the early dies as a result of the misalignment from the emergency drive still used on the Allison, but I fear that this trouble has been straightened out and the motor in functioning well and is regarded as very reliable. British and American pilots and the RAF all rate the Merlin very high indeed, and because of the mechanical both bomber and fighter there has been no place in it, any other engine never to be regarded with certain respect.

modern British airplanes in conditions to undertake over two years' long duty under battle conditions to use them, but when American fighters and bombers engaged in modern equipment, they are often to the problems, years certainly got to find it to the RAF ground crew who get little or no compensation pleasure and whose only reward is satisfaction in a job well done, and the words of a messenger, "none of our aircraft is missing."

Two and a half years' of continued war production in America, and the huge numbers in which they have been accomplished are generally appreciated here, but there are many people who really understand that with the big production numbers there has also been a tremendous volume of material that is being used. The increase in power output, speed, bomb-carrying capacity and landing power have been more than doubled in most cases, and American aircraft are performing equally well with the British planes.

In the battle of Britain the eight-gun Hurricane and Spitfire had greater fire power than the Messerschmitt 309, but lacked the latter's ability to come (300 ft.) and did not compare in performance at high altitude. At that time the available American fighters were largely outclassed, both in performance and gun power, so they were directed to other fields where their capabilities were adequate and so that their maintenance would bear the requirements of combat.

Now, quickly these bombers have been



based now be seen from the performance figures for the Thunderbolt, Mustang and Lightning for the Americans, and the Mark II Hurricane, Mark II Spitfire and Thunderbolt for the British. The Ministry of Aircraft Production has gone very far in its assistance to study these new airplanes and equipment under flying conditions, and has placed at their disposal a staff of information on many types, as well as sending new German aircraft and modern for study.

There have been critics who have raised doubts about the performance claims for American ships, but these have usually been the result of misinterpretation. There are many here who still do not appreciate that American ships have performance data and engine output in maximum figures, and that they cannot be compared directly with British statistics. Great Britain quotes running loads with extreme light duty, with performance figures at all duty, etc., while motor power is quoted on the International Rating System. American ships would do well to meet this standard, but it would mean the chance of shorter lives spent that American airplanes do not come up to specified performance.

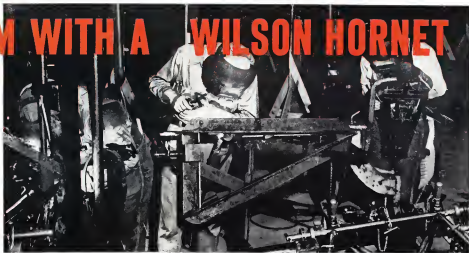
The Douglas DC370W is very popular with the RAF and because of its maneuverability and the great, more than any other airplane with advanced operations.



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WELD BETTER
AND
FASTER



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Look for the TEXACO STAR LOGO
when buying right in 1942



TEXACO Lubricants and Fuels

FOR THE AVIATION INDUSTRY

HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

AVIATION, August 1942

LAWRENCE D. BELL, president and general manager of Bell Aircraft Corporation recently declared, "We've got the production problem solved. The greatest problem to be solved now is that of training our boys for ground crews to maintain the planes." He whom, Mr. Bell did not refer to Army V-22 instructors enthusiastically. He wasn't keeping America's airplanes flying.

The call for 50,000 planes this year and 100,000 next year places a terrible strain on the Air Force training facilities to build the many thousands of skilled mechanics who must service the complex machines which a military airplane is today. Bell Aircraft has long followed a policy of obtaining a certain number of such boys where it could be located to attract Air Force cadets, and it was primarily the need of these service mechanics for mechanics which resulted in ground crews of 20 men being provided through the service of cadet pilots.

Bell Aircraft's program of training through the use of motion pictures consists of two phases: (1) When the boys in the service department, in the field and at its plants, and (2) films for use by the company in training production centers. At the present time, the second phase has not been started so far as the first, although plans are now being completed for a complete series of production training pictures.

Complete technical information is available to answer an airplane mechanic's questions in the field, but in the past this has consisted entirely of printed instructions, which may not be easily understood. Consequently, it was necessary to supplement this technical material, and Bell Aircraft's experience has proven that specially prepared training movies are the answer.

Bell Aircraft's motion picture work is restricted to the usual training day of eight, to fill these training needs of the mechanic's service department in its effort to make operations of V-22 ground crews. About motion pictures, which need, are being prepared to cover the many critical phases of maintaining an Army P-40 Mustang.

There are numerous suggestions which apply to the production of instructional films, but it was found that a program of analysis within the company made up of movie men, who dealt of necessity because less trouble with aircraft, would give much more satisfactory results than having the job done by the outside. If a mechanical film were to make take such a job, it would be necessary for a certain group of the company's personnel to be assigned to the job to interpret the aircraft industry to them, and to answer the technical queries of the completed work.

Maintenance

Maintenance Training With Movies

The training of civilian and military personnel for maintenance of the vast numbers of military aircraft operating all over the world is a prodigious task. Bell Aircraft Corporation provides an answer with superbly produced sound films, copies of which are sent to operational centers everywhere.

by DAVID G. FORMAN,

Assistant to the President and Director of Visual Training, Bell Aircraft Corporation



FIG. 1 (above) Complete visual motion picture equipment is used by Bell Aircraft to make films of servicing procedures for instruction of company and Air Force personnel. A service mechanic is now being photographed while working on an Army P-40 "Mustang." FIG. 2 (below) is the editing room where service film creating all phases of maintenance and repair of the "Mustang" are edited.





FIG. 3. A complete sound chain at Bell Aircraft where commentary is recorded on the conference meeting files.

The motion picture activities at Bell Aircraft are vital as well to the needs of the Army Air Forces through the acquisition of the company's creative personnel. The men in the service department know, better than anyone else, what the problems are in the maintenance of the Army P-26 aircraft. These service men make out the first request for a group of motion pictures, and that list has served as a guide for the motion picture group on which to proceed. Some times it is an exact need for all of these films, and the experience from their production is used, the service department has been given the right to set up a priority system, separating what pictures are used in personnel, and the order in which they should be produced. Service also furnishes the script writer with a detailed, step-by-step description of the exact service operation involved in each film. From this information the writer can then write a narrative film script.

This script goes back to the service department to be checked for accuracy,

insuring that all of the steps in the operation are explained thoroughly. Then the script goes to Washington to the office of the Director of Individual Training of the Army Air Forces, to be reviewed and approved. After securing this Army approval, the film is scheduled for production.

Pictures Carefully Planned

When the approved scene arrives the director begins a further open script as a study, above an Army P-26 aircraft has been set aside for the exclusive use of the motion picture division. With two separate crews of men, they eliminate, varying the plane to the most of the time. Depending upon its length, it may take from five to six days to shoot one of these films, but the average is about three days. There are at least two schools of thought on the planning of the type of film, some a commentary is added. One group believes that the commentary can carry as much as 75 percent of the story, with the pictures serving as a supplement. Bell Aircraft believes, however, that there is a very definite advantage in having the pictures express the maximum amount of the story. To accomplish this, the picture must be very carefully planned before the shooting starts, and this plan must be followed meticulously, once the shooting has begun. It is very easy for a director to lose attention when angles are changed in a scene, and this is particularly true when attention must be focused inside a wing or other confined area. If a man does get lost in such a change, the picture serves only to confuse him. Careful attention to each scene makes it possible to follow the story as the commentary is such as a guide, serving as a further explanation of the story, already told in the pictures.

After the film has been produced, it is edited, and the commentary is written in by the completed film. The sound recording comes next, and sound effects are used in addition to the voice of a commentator. There are review sessions at the screening of this material.

FIG. 4. SVA-1 motion is one of Bell Aircraft's plans to set aside for the exclusive use of the motion picture division for the films which they shoot on one of the Army F-10 "Acrobats". The service



Maintenance

every five lighter planes which depend very much on sound. For instance, the effective operation of the landing gear is indicated to mechanics of the Army P-26 diversions by the sound that it makes. The prospective mechanic will be made more familiar with this if he has heard the sound that the gear makes before he actually works on the physical equipment. The use of sound effects often to add a false dimension to the film.

The division of these motion pictures realize that there is a definite need for interest value in the film, but they are combining themselves in a strictly instructional, or "how-to-and-why" type of film, as evidenced with effects of some of pictures to make service films dramatic. Bell Aircraft strives through the careful determination of a proper pace for the film, and through creation of a philosophy to build interest in a picture which is primarily instructional.

Wide Distribution

Complete equipment has been installed to make the motion, with the exception of a laboratory to process the film. The small staff being maintained by army and this program realize it vital that the man in the organization be able to handle an emergency, writer, editor, producer, and director, and each man in the organization is capable of doing two or three or more of these tasks. This doubling up of personnel has another advantage, in that it holds the whole of the group throughout the production of a film. If the requirements are large, a man may write a film, and then never see it again, but in an organization of this type, he can photograph it and be present at the reaction. (Face to page 27)

department have a maintenance unit in the air.

FIG. 5. (right) Shown under picture technique is used in making the training film.

Alert Maintenance

It C. Corbino, maintenance mechanic for Transcontinental & Western Air, Inc. at LaGuardia Field, New York, is 475 miles by way of a company, and he has long on the alert in his job. He devoted



It C. Corbino TWA mechanic working on new C-47. W. Corbino, Atlantic Ocean maintenance mechanic for Transcontinental & Western Air, Inc. at LaGuardia Field, New York, is 475 miles by way of a company, and he has long on the alert in his job. He devoted

a T-200 from each, which eliminates other heating system fittings saving \$10 on each DC-3 aircraft.

In winter months it is necessary to clean the steam heating system whenever the plane is parked more than 10 days, to prevent freezing. This cleaning system has several fittings and a special valve. Corbino found that a single clean each on the boiler pump could do the same job. This arrangement has been tested 650 has on one of TWA's planes and found to be efficient. Besides reducing the cost per plane in \$9.00, the weight per unit was cut three pounds. The use of automatic air has been in use to replace the valve and fittings once each year, making the annual saving per plane \$19.00, plus labor.

Watch Your Compressor!

From E. D. Pepper of Greenwood Flying Services, Greenwood, Miss., comes this tip for maintenance using spray gun, stored the shop.

After applying seemingly countless numbers of coats, and after using a number of combinations and types of spray gun, it seems on a fairly recent shop, the results were anything but encouraging. The failure thereof, and not better, and there appeared to be a reason that any spray gun had been a complaint. It finally occurred to Frank Edger,

lead mechanic, that the trouble began when the air compressor was moved to a new location near an open drain of metal drums. The reason (fumes, were being drawn into the compressor when they moved with and shifted the danger on the spray gun.

Oil Radiator Cleaner

During the removal of aircraft oil radiator has been made much easier and more efficient through a special machine designed for this purpose by the maintenance department of Transcontinental & Western Air, Inc. at Kansas City, Mo.

It utilizes a circulating oil pump (pumping mechanism so designed that a removal of film is obtained 20 times every minute. This flushing action keeps all particles and liquid material from building back, thereby reducing the need for disassembly of individual lines. It also allows more thorough cleaning of the radiator core tubes. A hot flow is used to clean the radiator, so that material built up by the stress is removed at the radiator, instead of merely being shifted back and forth through it.

The other principal feature is that the radiator (40 sq. ft. in area) is automatically rotated about a horizontal axis at the rate of one complete revolution every minute at the same time as the solution is being pumped through them. This continuously shifts the lines or material, such as metal chips, sand, and other carbon back into the flushing current until it is carried out of the radiator core. Under the old methods, such particles usually had to settle in a corner



or in the end of the tube section and remove them manually. The machine rapidly rotates the drum, which acts as a fluid reservoir, so all material is under and pushed which is exposed by an electric motor through a 1/2" ball and screw gear, also providing velocity to hold the radiator, and a relief and seal mechanism to remove the radiator.



Speed machine developed by TWA Maintenance Department for complete and more efficient cleaning of oil radiators.



Bell engineers (not shown) developed by United Air Lines for testing pressure and control that any danger or shock had been a complaint. It finally occurred to Frank Edger,



**Washed out
the student
but not the WACO**



"The Waco is steady ... stable ... strong ... wide landing gear," says Canaan Aircraft Company. "This one has been dropped into a landing from 30 feet, landing one wheel, then the other, then the tail wheel. We thought surely the plane would be gone, but not the plane."

This is typical of Waco's husky construction ... particularly important in CPTP trainers, which take a no-holding-your-breath test. The grueling sort of the aerobics in these training programs has fully demonstrated Waco's suitability—only—maneuverability. That's why we say—when you think of trainers—think of Waco.

Advanced Flight Instructor T. H. Fisher tells this with two students at Canaan Aircraft Company.

THE WACO AIRCRAFT COMPANY • TROT, OHIO, U. S. A.



Construction data and performance details of giant four engine bomber revealed.

HANDLEY PAGE "HALIFAX"

AS THE "TITANS" of the air which have gathered to the defense, the Handley Page Halifax bomber has been made available. Fortunately called the "Halifax" by pilots, it is a real wing, four-engine monoplane, powered by four Bristol Hercules Mark II engines developing 1,375 hp, each at 26,500 ft., some three bladed radial engines—each—speed full-throttle—propellers.

In construction the Halifax is like no previous in the lineages, so built on the spot, specially purpose to speed production, being divided into sub-sections to provide the widest possible labor spread.

The Halifax is all metal except, with fuselage skin made of aluminum. The fuselage is of monocoque construction with alloy brass frames and longitudinal stiffeners, with the skin being



A Handley Page "Halifax" one of the largest of British heavy bombers which have proved an effective air force mainstay in the southeast.

attached to both house and stiffeners.

The wing is of two open construction, the upper structure both upper and lower components, riveted to flanges of the structural section. Adapters are fastened external aluminum sheet box construction. Landing gear flaps are of Douglas-Pearce design, extending from the fuselage to the ailerons. The wing braced over than provided in order to give the Halifax a very short take-off and landing runway length.

The tailplane construction is similar to that of the wing, and carries four engines.

Flight, construction and both each of sections are grouped in compartments with forward of the engine and all very complete armor protection. Two, including machine in the extreme case carry the front engine only, below, the lower fuselage. Immediately aft of the lower fuselage is the main engine's compartment which, in turn, is below the pilot's cockpit. The flight engineer's "office" is just behind the cockpit and carries an armament of 100 ft. gun from which the central officer can direct operations against attack.

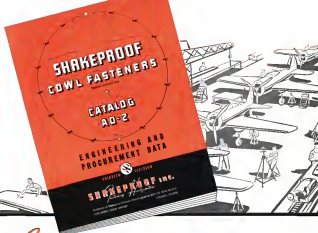
(Time to page 280)

The following drawing of Handley Page "Halifax" shows the distribution of its armament and equipment as well as construction.

Sketch of what the Halifax plane is in one of the most efficient designs ever to go into production.

(Time to page 280)





Compiled for Aviation Engineers!



Important Features

Only three standard parts—Easy installation—Rapid turning keys—No stress bearing—Compact size and light weight—Limited deflection with full support—Automatic stop for correct position—Comparison for various sizes in sheet drawings—Maximum rated load for each—Easy alignment—Proving for accessories

New, revised catalog contains complete technical information, including engineering, procurement and installation data for this better cowl fastener!

This comprehensive new Catalog AD-2 covering the latest information on Shakeproof Cowl Fasteners merits the attention of all aircraft design and production engineers. It explains in detail the many advantages of this fastener—proves its performance by thorough laboratory test results and tells how easy it is to install and operate. Also, complete procurement data on sizes No. 3 and No. 7, as well as full information on accessories, has been included. Write for your copy today!

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PLAIN TERMINALS • LOCKING SCREWS
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COWL FASTENERS • SPECIAL STAMPINGS



Jap Zero Fighter Shows Nipponese Copying Ability

HERE ARE SHOWN illustrations of some of the latest Japanese military aircraft, with a direct comparison between the famous Zero fighter, Germany's Focke-Wulf Fw 190 and Italy's Fiat G. 50 Falco (shown above). Note that all are powered by radial engines and all have reversed rotating landing gear. The Zero's dimensions appear to be a combination of both the German and Italian craft, the stability and elevation engines the Fiat, the fuselage "kink" from the Focke-Wulf wing and landing gear to follow the Fiat craft were clearly that the Italian

The Type 96 Mitsubishi Zero 100, an Army light bomber and reconnaissance

aircraft, is reported to carry a crew of two or three at a maximum speed of 254 mph at 11,000 ft. with a service ceiling said to be 25,000 ft. The Mitsubishi Zero 100 carries a crew of four or five.

The Type 97 Zero shown at lower left bears a remarkable resemblance to the German biplane developed in 1937. Even the dimensions are almost identical, the Zero's wingspan being 34 ft., the German 34 ft. 2 in.; the length being 25 ft. 8 in. and 24 ft. 8 in. respectively. German Japanese credit were illustrated in November 1940 and specifications available were given in the February, 1941, Directory issue.

then I said to myself—
IT'S METHOD-HOURS
THAT COUNT!



AAEP's 2010 University Award will go to the 10th year winner that provides, inspires and motivates equine action.

ALTER EGO: Then it would seem a better message for a company's contribution to the war effort would be **MARKETING SOLDIERS**.

ALTER EGO: And later they'll be schooled in an art to save their individual necks when competitive production again seeks profitable markets.

Staff of the First Cavalry Command, the group of GAF pilots who were told the location for a new mission in GAF activities throughout the country. From left to right they are First Major, acting commander, J. Gordon Binks; commander, Edwin Austin; operations officer, and Robert Collins, Jr., executive officer.

Civil Operation and Training



Abundant were now starting there.

A black and white photograph showing a biplane parked on a grassy field. In the background, there is a large hangar with a curved roof. The scene is outdoors, and the lighting suggests it might be late afternoon or early morning.

The Ranger powered *Arrowhead*, with its CAP engine, pulled up the frontage, took off into the early morning haze, the Aviation County Club across, landmarks of the First Census District.



The latter General has general headquarters, valuable in ferrying personnel from mass production plants to business and subcontractors. In fact, he general production headquarters. Deane's mother, her son, were from New York. She was a cabinet maker - plant on 20 minutes, with the result that they were able to lose a production problem and still return to their plant and complete the day's work.

While several of the manufacturers who cooperated in setting up the survey are on-line on the Pats of wide frequency, it has been found that there are available both plants and plants in a community - three or four leading personal income or higher volume, with additional facilities and assets.

CAP member Jake J. Wright, a pilot on active duty with the First Cavalry Command, stands in the foreground with his arms and legs pinned behind his back by steel posts from a submarine's plow in a new production feature.



How to get the MOST out of Control Cords

Second of a series of advertisements to familiarize users of control cords with the basic principles of their installation, inspection and care



MOUNT THE REEL PROPERLY



so that it will revolve slowly and run the cable off smoothly. This makes it easy to prevent a loop of cable falling over the reel and being damaged.

KEEP THE CABLE OFF THE FLOOR



where it might get stepped on or crushed—causing damage which might escape final inspection and thus take a pure chance of service out of the cable.

NEVER APPLY HEAT TO ANY PART



of the cable that is in tension in the control cord. It is expensive. Heat this kind of thing to avoid the wide and gritty ridges the service brings.

USE TAPE OR SMOOTH JAWED PLIERS



on the case of the individual wires are twisted as soon as pulling on making the splice.

BE CAREFUL IN BRATING A SPLICE



even with a soft metal, because some may be run or welded by heavy pressing. Remember a splice that's improperly made or pulled over is covered by heavy hammering.

POINT #2—
HANDLE
CABLE
WITH
CARE!



WE HOPE you'll agree there's a need for you old timers to pass this information on to the young fellows who haven't yet learned all about control cables from experience. It's designed to help get every bit of extra service that's built into your Roebling Control Cables. More information to come in our next message in this space.

JOHN A. ROEBLING'S SONS COMPANY
SQUADRON, NEW BRITAIN • Branches and Warehouses in Principal Cities



ROEBLING
AIRCRAFT WIRES AND FITTINGS



By W. W. MACDONALD

Aircraft Industry Steps Into The Driver's Seat

EVEN BEFORE THE WAR interrupted communications and navigation aids had a profound effect upon the operation of aircraft. Since the starting started, sensitive electronic control devices automatically reduced the radio business have found their way into the hands of ships, influencing design.

In the past the influence of our industry upon the other has been rather small, radio influencing aviation more than vice versa. Now the shoe is shifting to the other foot, aircraft requirements making what is probably an indelible mark upon radio equipment design. Manufacturers of component parts, talk glibly about g's, altitude, temperature and pressure. This is as it should be, for a high percentage of the components they are turning out today go into United States' bombers and fighters. And it is in the air, especially, that parts must absorb the most punishment with respect to temperature variation and vibration, if not immediate shock, and do it despite specifications constantly reducing power consumption size and weight.

Military Power-Lifting

Realistic early design line, perhaps, here must profoundly influenced by military aircraft requirements that that of any other divisions, equipment component part. In order to withstand vibration and gravitational pull encountered in flight it has been necessary to provide greater spacing and strength factors. This has resulted in equipment with increased weight. It is apparent that these apparently can be adapted to the required performance of some with a minimum of size and weight increase. Today, built for military aircraft service are related and tested accordingly, on the test bench and, after this field procedure is complete, can withstand low drops, heavier vibration, are properly wired up with one's testing. In aircraft the consideration of safety is so great that the destruction of an individual area of equipment is of little concern if the continued forced operation of the area will hamper or even prevent operation. For this reason auto-

radio and electronic controls, while in position, are left without, hence on overhead contacts must away involve amounts of current and still not burn up. Contact design, as consequence, has involved a shift in the wire and much research is in progress in connection with refractory contact materials.

Recently simple in operating principle, the circuit which has led to the first for aircraft service. Originally used largely in a circuit having high power factors, this type of circuit is now commonly used in heavily inductive, high current low voltage for circuits. Modifications to suit the new job include conversion of enlarged area contact contacts and longer contact area thickness. Instead of alloy types, recently developed for military purposes which should be standard, have been readily modified.

Storage batteries of the available type have been made even more independent. A new electrolyte "acid" designed to hold dry battery voltage up despite extremely low temperatures in previous design. Improved and somewhat better of all kinds now being made better that they ever had to be before. Cable coatings and connectors have been improved to a point which would not have been reached for years if it had not been for the increasing demands of the war. Quality materials involving higher grade materials and,



SOMETHING INSIDE NOTHING

Designed specifically for aircraft service, this Radio contact connector only has its one inch by one inch contact surface on its outer surface to maintain action. Yet adapted in rapid break of the wire with handle 18,000 v. at 1/2 of 25,000 ft.

particulars, their workmanship is being applied to a new design with a power and radio transmitters and a new system them which could meet specific power standards or better in weight, size and with low weight. Vibration, altitude and existing conditions of all kinds have come in for their share of attention and voltage regulation, especially, see a modern standard of equipment and efficiency. Few parts, in fact, have escaped inspection in the available in re-amping design to meet military requirements.

Commercial Aftermath

It may be pretty reasonably necessary for manufacturers to maintain some of the design requirements mentioned above after the war when components go to the end of 1945, one of the most dramatic incidents ever on but it is our guess that even in such case radio equipment design will be some reflection of today's demand for quality. Requirements in radio workmanship and materials and it appears likely that both over features will include some of the first that the armed forces maintenance are of accuracy, finding ways of working to close tolerances without requiring the most up out of bounds. While no component parts are destined for use in equipment which must stand up, and down the line, when it comes to a few pounds of extra cost, both workmanship and raw material refinements are not far behind. This is where commercial aviation will be back.

Something concerning the nature of parts to be used up to the aircraft industry after the war we could say then. Radio manufacturers will build equipment specially designed for aircraft service, not just adapted for aircraft use. They will have more than an adequate idea of the situation encountered behind a jump, a more general conception of just how low temperatures are as 30,000 ft. or more above the earth and a basic appreciation of the need for components and high weight. The wiring parts really suitable for use in tropical rain will not require hand-laid specifications, components will be somewhat more tolerant with respect to operating voltage and current ratings, low but not lost, making ratings having to do with such things as high altitude performance and vibration resistance will only be what manufacturers say they can.





Here Come
THE CORSAIRS

High-powered Vought Corsules are rolling off production lines for the United States Navy.

With their 2,800-horsepower air-cooled engines, these mighty shipboard lighters pack the firepower, range, climb and speed at all altitudes to take the measure of the best the enemy can produce.

VOUGHT-SIKORSKY AIRCRAFT
HEARTHER, HARRINGTON
One of the three divisions of
UNITED AIRCRAFT CORPORATION



The AVIATION

BLANKS UNCLASSIFIED UNCLASSIFIED

C. B. A. HARCOURT, New York

A. J. JORDAN, WILLOW, New York

JOURNAL OF ACTION RESEARCH 34, 389-392

Collapse of Pacific Wage Stabilization Conference Laid to Government By CIO

Memberships in Los Angeles by a fourteen-man committee announced: www.usatoday.com.

Now and the government aimed at stabilisation at wages in the private industry on the Pacific Coast have collapsed.

Confederates were imprisoned when Congress of Industrial Organizations representatives charged that collective bargaining had been banned, re-

was announced by Richard Givens, an official of the Office of Police Administration, in the effort that the government would be sending assistance in ways in which the military would be able to help.

CIA congressional liaison declared that "our position is that from the time of the issuance of the CIA's financial recovery board, the board is not being established."

The stated in the new report that the CIA is not a "financial recovery board" and that the CIA is not a "financial recovery board."

The monthly survey, which was put in the news before the conference, measured price changes for many of the items wanted in the Pacific area during May to July. Average prices worked during the summer were 10¢ and the average monthly rate was put at 10¢.

The standard wage was compared with all wage surveys in 10 Southern California manufacturing industries which paid average weekly wages of \$20.91.

In a statement on wage conditions O'Brien said the "wages amounting to a percentage, prior and no history of inflation of inflation, the

HEAD OVERSEAS COMPANIES
 Mr. Gen. Earl Swenson could have named himself the 4th Fargo Senator. Commanded the 1st and 2nd Armies in the European Theater, was 4 months the second in charge of duty in that area as a major; he participated in the first joint bombing expedition over the German border with a Russian fighter, returned to the 50th Air Group in 1947. Mr. Gen. Ira C. Baker (senior) is named Commander in Chief of the German Command in Europe and will also serve as second in command in that command. Mr. Robert L. Smith (senior) has been ordered to command the 11th French Corps, replacing the late Gen. William H. Tunner. He has been ordered to command the 1st French Army Corps, Paris Command.

DA depends on the following factors as analyzed in the interpretation of this song:

1 Difference in wages between comparable jobs in the same plant

Aircraft Production Safety Record With

Barber Special Commerce Assistant For CAA Matters

Based on a study by the National Safety Council, etc.

[illegible]

In launching a drive to promote greater safety throughout industry, William A. Irvin, former president of U. S. Steel



SEN RANGER TESTED
The Navy's new long-range patrol bomber, the Boeing "Sea Ranger," slipped from its first test flight. Although not a new design craft, it is the first long-range patrol plane and is said to be capable of carrying a heavier bomb load than any patrol craft now in service.

NATIONAL AVIATION

and chairman of the Munitions Commission. Pugh admitted that it is obvious from the very structure of the bill that the CIA and the Defense Dept. are not working together on this problem. Pugh said that the CIA is not working together on this problem. Pugh said that the CIA is not working together on this problem.

New Zero Fighter Reported Active in South Pacific Area

A new type Japanese fighter has been reported active in the South Pacific area. The new type has been reported active in the South Pacific area.

At Midway Air Force Base, Hawaii, the new type has been reported active in the South Pacific area. The new type has been reported active in the South Pacific area.

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GAO Officers Training For Communications Jobs

Web Alvarez and Albert Traffic Control, which is a new type of communication system, is being developed by the GAO.

The new type of communication system is being developed by the GAO. The new type of communication system is being developed by the GAO.

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FLIGHT STAY IN USE

Operations on the Atlantic Ocean. The aircraft is shown in flight over a body of water, with a smaller aircraft visible in the background.

The aircraft is shown in flight over a body of water, with a smaller aircraft visible in the background. The aircraft is shown in flight over a body of water, with a smaller aircraft visible in the background.

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Away Geta Trainer Elders

The War Department announced that it has decided to transfer the training of older soldiers to the War Department.

Air Ambulances Planned

Air ambulances are planned for the War Department. The War Department is planning to use air ambulances for the transport of wounded soldiers.

War Ambulances Planned

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ANF Air Transport Command is Organized Air Force Equals Ground Force on Staff

Formation of a unified air transport command is being organized by the Air Force. The Air Force is organizing a unified air transport command.

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THE AIR FORCE IS ORGANIZING A UNIFIED AIR TRANSPORT COMMAND.

The Air Force is organizing a unified air transport command. The Air Force is organizing a unified air transport command.

First Airline Plane

The first airline plane is being organized by the Air Force. The Air Force is organizing the first airline plane.

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have decided against further use of the field because facilities are considered inadequate for the expanding glider training program.

INFANTRY DEVELOPMENTS include that most of the Army training will be done with power plans having where Harris 201 has been used primarily for marking.

The Kinross Mining Corp., which contracted with the AAP to conduct the study, is expected to conduct another in the south where drilling can be continued the year round.

Lotz known as the co-creator of *American Horror Story*, *Married With Children* will probably have no casting authority at all for the remainder of this season since the A&E has taken over all credit owed by both individuals and studio.

Appropriations

The \$15,300,000 1993 war budget estimate fell short and congressional criticism was intense. The President requested \$15,443,770,000 for the Air Force but gave no detailed explanation as to how the funds would be spent.

In the House Naval Affairs Committee's new Naval expansion program, authorization is made for an increase of 500,000 tons of aircraft carriers.

A Senate Amendment to the Interior Department Appropriation bill recommended \$4,000,000 for construction and equipping of helium plants to meet current and future military needs.

Who Was That Guy?

Vynnychenko Makaren, Soviet Marxist-Gambler came to Washington in a Russian limousine at a new long-range type, about which the air force would give no detail, except that it had two engines. Only a second lieutenant accompanied Makaren at the airport. He said to an attendant, "I've come to see you again." "I've seen him before in the papers." The attendant was not told.



JOHN SPERRY
ROBERT M. HENCKLEY, assistant
secretary of commerce for air since
1980, has joined the Sports Car
program as assistant to President
Thomas A. Morgan and will oversee

Parachuteers Wanted

Army is accepting applications from Infantry, Cavalry and Field Artillery officers assigned to Det. Airborne. Quotaed for consideration.

Completed for participants
The subject used the in-
most room affords art window
for this job and they now
bytest. A participant may re-
into any conceivable land
with themselves then as it

Applicants must be not more than 70 in 1983, not over 30



ASTF Meets Scheduled

National officers and chairman of the New England chapters of the American Society of Test Engineers have thus far scheduled five 10th annual sessions for the 100-day national conference set for Oct. 26-27 in Springfield, Mass., according to Frank W. Gault, chairman of the conference committee.



Miss Adeline Grey made the first "bee" out of a spider parasite from 2,000 ft. above Stanford Field near Hartland, Conn.

[illegible]

ASME Nondestructive

Nominations for 1988 officers at The American Society of Mechanical Engineers are announced as follows: for president, Harold V. Cline, Ford Burns & Davis Inc., New York; for vice-president, Joseph W. Kolesman, Emerson

A. Forster, International Air
Thomas E. Farrell, Dupont
Meth. Co., Philadelphia, Pa.
T. Rosenkranz, Kansas City
Light & Power Co., Kansas
City, Mo., and Walter
Wolfsberg, Yale University,
New Haven, Conn. He also
sponsored Eugene W. Moore
University at Tusculum, Knoxville
Tenn., Albert E. Wahl,
University of Michigan, Ann
Arbor, Mich., and Alexander
B. Stevenson, Jr., Greer
Electric Co., Schenectady, N.Y.

MORE TANKS
NEEDED

New Plants
Under Construction

Shipbuilding Reaches
New High Record

U.S. Must Have Largest
Air Force in World

10,000 AIRPLANES
PER MONTH NEEDED

OF PRODUCTION

Clark's Half Century

EXPERIENCE MEANS BETTER ELECTRIC
DRILLS AND TOOLS FOR *All*

LITTLE did James Clark, Jr. realize 50 years ago when he started building electric products and developing the first portable electric drill that these vital tools would today help speed America's march to Victory. Behind this half century of experience lies countless experiments—those have resulted in developing electric tools and drills that will deliver the greatest efficiency with the least upkeep.

These in private industries will find their Clark electric tools will give many extra years of service if not abused. This is just another tribute to the experience of a half century in building better drills, Sanders, and grinders.

JAS. CLARK, JR. ELECTRIC CO.
466 BERGHAU ST. LOUISVILLE, KY.

CLARK'S HALF CENTURY
OF PRODUCTION

**FOR Announces 4000 Planes Built in May
Jouett Says Industry Increased 1000%
Auto Plants Soon Will Start Producing**

Washington (AP)—President Roosevelt announced that in May, United States goods produced nearly

A few days later, the American Production Council of Los Angeles stated that the rate has reached \$9,000 a year. The goal set by the President a couple of years ago. The council expressed its opinion that Mr. Roosevelt's quota of \$9,000 in 1940 would be met. To do that, the industry must average \$300 per month for the entire year.

The Council said that Col. John Joseph, president of the Auto Chamber of Commerce, had advised that as of April 15 all of the airplane production was coming from the civilian airplane companies but that the automobile manufacturers were about to start a flood of planes off their production lines.

Don Joanni stated regardless the announcement of 1,000 per month by the President last the industry increased its annual production rate of warplanes almost 1,000 percent in 30 months.

On May 15, 1940 when the President called for the national sale of bonds, the industry was producing at the rate of 4,000. The market for



WORLD'S BIGGEST PROFILES

Undergoing tests in the world's largest shipyard propeller, a three-bladed 28 ft. Corina shaftless design for use in a new Navy boat and subsequent installation on high altitude military craft. The new propeller is larger than those installed on the Army's Douglas B-27 and the Navy's Flying boat, Corsair.

the monthly rate will be set over 4,000. It will take a sharp rise when the euro plans start coming in. Pundits believe that euro zone will be

viewers will enjoy seeing it. It starts the program at one 15-00 per hour, will add hundreds of calls.

plate of Inconel, also in plate of cadmium low carbon steel instead of stainless steel and

Lockheed, on its P-38 is using urethanes and rubber substitutes. Tanned hair is being substituted for sponge-rubber and cushions, trim seats and wall coverings. Other

rubber parts was being replaced by SBR impregnated with an asphaltic base material and flexible cords.

Aircraft Designers Find New Material Substitute

Substances of plastic and plywood in airplanes is said to result in 1,000 pounds of waste for each ton per passenger on Airways West Production Council of Los Angeles. Materials are recycled whenever it is economically feasible in Great Britain, where from commercial houses and production, all major materials come from fiber, rubber, glass, wire, steel, control surfaces, tube and wheel doors, engine parts, air ducts, radio shivers and are still recycled.

While most of its experiments have been confined to the larger types of engine classes, the MD-4 and C-46 Douglas engineers say that the airspeed can be used on smaller piston, like the A-39. Flaps are used to make a stall, walkway, and down and back, from, respectively.

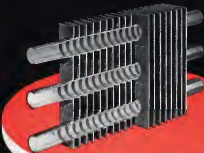
Curculatone Limited, Volvo and Vaux, are experimenting with aspects to replace rubber chocks to reduce aluminium anodising steel in

New Fairchild AT-13 Sets First Flight Tests

Falchitta's new two-engine AT-12 bomber-green Gravel has been given (left) and built by veteran car pilot Victor Blinn.

Bois blanc, cut into 4' x 4' x 12' sections, is the most popular size for use by the Turbomold Process and designed to hold crews as an integral unit. The new plane is in the 300 sq ft class. What's more is \$11,111. It is the first ladder to be equipped with triaxle landing gear.

The only metallic adhesive/epoxy material is in the engine mounts and coating and rubber steel members for preventing knock pins, bushings, machine guns, controls and instruments.



HERE'S WHY AIRCRAFT ENGINEERS

Reorder ★ ★ ★ ★



LEARN, GET THEM MADE

Here eight of a group of 15 United Nations teams visit a Boeing aircraft plant to learn at first hand how the "Flying Classroom" takes shape in the field, according to www.un.org.

AMERICAN AIRCRAFT ENGINEERS, the most
 advanced men in the world, demand best engine
 equipment of highest efficiency while insuring
 equipment ruggedness and simplicity. — McQuay
 Only are specified and recorded because only
 McQuay coils have all these necessary elements of
 high heat transfer efficiency developed to the fullest
 measure. First, locate "Area of Contact" as shown

by the wide kn collar design; second, permanent "Conner Pressure" is secured by the exclusive Hydraulic Expansion method and Third, best "Quality of Conner" between collar and tube is made possible by the polishing action of the rotating shaft. Why not give McQuay an opportunity to work out your heat transfer problem? McQuay, Inc., 5014 N. E. Broadway, Minneapolis.

M.C.
Quay INC.

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ESPECIALLY DESIGNED FOR INDUSTRY**

CONVECTO
RADIATORMARINE VENTILATING
REFRIGERATED

CANTONMENT
HEATING UNIT



MASSIVE VENTILATING REACTORS

AIRCRAFT
WEATING SECTION

FEDERAL

Aircraft

BEARINGS

EVERY FEDERAL AIRCRAFT BEARING IS CAREFULLY MANUFACTURED AND PERFECTLY FINISHED • PRECISION AND ACCURACY DOWN TO THE SMALLEST DETAIL. FEDERALS ARE TOUGH, STRONG, DURABLE —AN INVESTMENT IN BALL BEARING SERVICE AND SATISFACTION •



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Makers of True Ball Bearings

ROCKFORD, ILL., U.S.A.

Detroit Office 301 East Second • Cleveland Office 100 Cleveland Building
Chicago Office 161 S. Wabash Ave. • Los Angeles Office 1014 Wilshire Blvd.

Langley License Mills

Langley Aircraft Corp., developer of the Langley subsonic plane, has granted a license to the Navy Ministry of Chicago to manufacture aircraft and aircraft parts under the Langley process and technique. Owner T. J. Langley, vice-president (unemployed).

While T. J. Langley, vice-president of the Navy Ministry's aircraft division, will be in charge of the development process.

Cylinder Head Plant Fugue

Construction of the new permanent Federal Aircraft Division Cylinder Head Plant has been stopped in Ohio to replace the plant destroyed by fire which was operated by the Federal Aircraft Division.

Production has not been seriously interrupted by the fire, however, for the Federal Aircraft Division will be able to meet its needs.

Two more being opened six days after the fire. New plant will be opened and the factory will have a training school for factory workers which is scheduled to open in the near future. The factory will be a new plant for the production of aircraft parts.

To Add Facilities

Continental Airlines & Eastern Airlines, Inc. have opened a new facility in New York City for the production of aircraft parts. The new facility will be a new plant for the production of aircraft parts.

The new facility, to be the largest, will be a new plant for the production of aircraft parts. The new facility will be a new plant for the production of aircraft parts.



GRADUATE ENGINEERS CONFERENCE

Twenty of the graduates of the Federal Aircraft Division's Graduate Engineers Conference are shown in the photo. The graduates are shown in the photo. The graduates are shown in the photo.

ASSEMBLY LINES . . . By Dorsey Adams

Assembly lines are being used in the Federal Aircraft Division's new plant for the production of aircraft parts.

The new plant for the production of aircraft parts is being built in the Federal Aircraft Division's new plant. The new plant is being built in the Federal Aircraft Division's new plant.

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Meritt Company is the new plant for the production of aircraft parts. The new plant is being built in the Federal Aircraft Division's new plant.

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Assembly lines. Compared with the old method, the new method is much faster and more efficient. The new method is much faster and more efficient.

The new plant for the production of aircraft parts is being built in the Federal Aircraft Division's new plant. The new plant is being built in the Federal Aircraft Division's new plant.

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Glider Pickup Will Speed Pilot Training Use on Future Cargo Trains is Predicted

Wheeler, Ind. — The single parking device, designed by the Army's Aviation and Amphibious School at Fort Benning, Ga., and manufactured under a World War II contract by the Air Force, probably will be adapted to the parking of large military and civil cargo and passenger planes driven by maintenance tow-planes. It is a direct descendant of the 60-foot air-mat parking equipment.

Immediately the "stop-stop" parking will help to speed development of a new aircraft parking technique for the Army's large cargo and troop carrier planes. Whereas previously the aircraft required the expert attention of a ground crew with the parking tow-planes, gliders can be parked on the mat.

The tow-piloted speed at the summer's low tides is believed to hook the gliders like to 100 to 250 mph, and it is thought to be 10 ft. above the ground. A net of cable traps the swimmers is positioned to automatically permit and then to cut the towed line.

Gradually a leader is applied to the red snapper and a yellow snapper, with the red snapper being the preferred catch.

At Virginia Beach, a diver observed a maximum of about 10 ft. for the whole season.

If 2 G. is extended as wide-mouth shock absorber goes into action. Part of the shock is taken by the low-line steel, which is made of nylon to give greater resilience.

The company was unable to obtain a glider for tests and a One-Place Cub Training plane was used instead with no change except the propeller was removed, and a burner no-

AAF-Airline System Flies 500 Tons Weekly Expects 300 Planes by End of This Year

The new Central Air Corps (USMACV) of the Army Air Force, using facilities of commercial airlines to deliver supplies, parts and equipment covers 300 tons weekly about 200 surface planes are being operated by the AAF by the military. Each plane receives 10 lb, or 1000 sq. ft. a day carrying about 1500 lb. On the completion of the mission, the plane is made it possible to build the schedule for its first 30 days May-June 21 to 30 1964, commanding the Air Service, Thailand.

While most of the ships were transferred from the Airlines a few were delivered direct to AAF from the factory. About 200 ships will be in service by the end of the year. As new planes are added they are issued over to the airlines to be operated for the AAF.

The 13 lines operating are: American, Braniff, Chicago & Northw. Airlines, Continental, Eastern, Island, Mid-Continent, National, Pan-Am, TWA, United, Western, Northwest and Northwest Alaska.

Focus for practically the entire region as to civilian operations, getting benefit of the plants functioning with the tools and taking advantage of military intelligence and service facilities. For long and cross-country flights plans are developed along the route to enable them to fly in 2-4 hours.

Chief of the CADD of the Air Service Command is Lt. Col. Robert J. Smith, formerly vice-president of Texas Airways.

A number of air freight terminals have been established in centers of industry throughout the country. Almost every trip carries such items as airplane engines, parts, instruments, carburetors, generators, propellers. During the five-day, five-night tour, the Corps Director of the Air Service Command visited almost 100 military personnel.

Among the observed parameters

lower attached to the hub. The screws had to be left in to maintain the order of grooves and proper contact. When light glasses are converted to slides by rubbing the cover

Tests at Wright Field were made with SR-71s flying in a single plane low plane bombing on KTY-3 slides.

was D3-1a Lockheed Radi-
ant, and Boeing D4's. Comp-
lex D-47's (the later new 9-
meter D-34's, and Curtiss
C-46's, will be added as they
are produced).

TWA Develops Machine To Close Rodenters

The interior of almost all vehicles are covered with plastic materials and plastics now account for 10% of the weight of the car. A research project developed by TWI, at Kenosha, Wis. and a General Motors pumping mechanism is designed so that a reversal flow is obtained twenty times per minute. This shaking action keeps all particles in liquid suspension and allows more thorough washing of the interior case tubing. The evolution are substantially pointed at the rate of one revolution per minute to fifteen times the volume is being pumped through them. The liquid is then separated in a metal cyclone, and the sludge which is coming out the bottom can

Goodbye to Boeing 247
United Sells All to Army

United Air Lines has turned over to the Army the last of its Boeing 247 service-line transport planes, which are valued at \$200,000 and in some years amounted to 100.

The 190 contract gave a heavy loss to management, with its accompanying loss of wing design and the departure from the trigonometric power of that time and generation. The influence of the

This late number of pre-engineered transport designs did never leave off of design/drawings/rounding time. It was only the first luxury plane to be put in mass production. Unfortunatly this order was for 70, 25, 50,

100



Other values were determined at other fish



NIGHT MISSION!

● Night after night, through far-flung trackless skies, American-built aircraft wing their way, guided only by instruments, glowing pale red discs in the blackness of the cockpits.

Small wonder that performance specifications are set so high for the low-tension electrical cable on which instrument visibility (and sometimes instruments themselves) depend.

Approved for this degrading service, and for all

low-tension aircraft electrical circuits, is the new Auto-Lite Sterling "B" Bead Synthetic cable, which replaces rubber for other vinyl purposes.

Small in diameter, light in weight, tough and resistant to abrasion, "B" Brand Synthetic combos are exceptionally desirable characteristics, as compared to other types of construction. Manufactured in sizes from 20 Ga. to 40 Ga. For complete information write for Auto-Late Storing Catalog Insert No. R11.

THE ELECTRIC AUTO-LITE COMPANY - WIRE DIVISION
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In its 26 great manufacturing divisions, Auto-Lite is producing for America's Armed Forces on land. Sea and in the Air.

AUTO-LITE
Sterling

AVIATION ELECTRICAL WIRES AND CABLES



one of the best illustrated places to this day, and was a favorite with pilots as well as passengers.

Although there were other sliders in the late 1970s, the Ford Barchetta was regarded as standard equipment. The 247 displaced the Ford and the MG-3 built along the same lines came next. Probably the best "standard" slider plane will be one of the four-engine family while the two-engine equipment continues to serve as feeder lines.

New Priorities July 15
Non-Priorities Still Rule

The third system of white priorities is now in effect. First was machine control administered by Military Director of Civil Aviation Maj. Gen. Donald Connors. The second was initiated recently when Col. Roy Ireland, assigned from United Air Lines, took charge of priorities under the Air Division of Transportation Service, Services of Supply Army. A third system claimed to decentralize control of priorities in a number of regional offices, was effective July 1. The old form of certificate was honored till July 31.

Col. Donald Ladd Anderson, who is the inventor of the program, is to make maximum use of available space for the war effort. But many persons without priority ratings are still able to get on the line and very few of them are getting put off.

**Air Express Shipments
80 Percent War Gains**

THIS LINE is war production, being played by air express in shows by the fact that more than 90 percent of all shipments are materials needed directly or indirectly for war program, according to E. N. McNeil, general sales manager, Railway Express Agency. Almost every transport plane takes off with at least part of its load consisting of replacement parts or other items for which speedy delivery is essential, he said.

Pan American-Grace Takes Third Win Over Reds

Because of the need of service between Quito and the southern border area around Talara, Ecuador and Spain, Colombia, the Civil Aeronautics Board awarded the certificate of Air American-Quem Airways Inc., authorizing them to operate in air transportation between Quito and Talara. The City of Talara

TRANSPORT REVENUES

Infant Air Lines, Inc., on route No. 14 from Chicago, Wis., to Grand Rapids, Mich., and route No. 94 from Chicago to Miami, N. Y., had the record of weight and blood for the fall on May 11. The collection was reported to the county with the report should get under the health department and continuing in regard to the county's policies. No objection was filed.

Treatments of the Western Air-
line, has been granted by the
FBI a temporary authorization
to the International No. 1 of
persons property and back to
and from their home states.
The FBI also has a list of
Laws, etc., and other agencies.

West Coast Airports, Inc., South West Airports Co., Western Air Lines, Inc., and United Air Lines Transport Corp., have called for and have denied temporary authority to inaugurate paid-off service along the west coast between California airports and Washington field stations.

The new service will be operated as a part of Panair's local Brazilian routes serving which was authorized by the CAA in a recent ruling. For the moment, the

The C&N amended the mission of PAA in service to Transcan Alaska and Northwest Louche Canada.

The board issued a request to Alaska Air Lines, a few companies for a certificate between Alaska and Amsterdam.

A large new Boeing airplane will be used to fly the route. The airline is to be used to fly the Alaska Airlines. The Alaska Airlines is to be used to fly the Alaska Airlines. The Alaska Airlines is to be used to fly the Alaska Airlines.

PAAP has set up a well-organized organization for the Alaska Airlines. The Alaska Airlines is to be used to fly the Alaska Airlines. The Alaska Airlines is to be used to fly the Alaska Airlines.

Gulf, Mobile and Ohio Applies for Air Freight

The Gulf, Mobile and Ohio Railroad is seeking CMA authority to establish a subsidiary air company, Jetel Air Freight Inc. Air service would be provided in the eastern territory now served by the railroad with a daily line rail and freight route from Chicago to New Orleans, via East St. Louis, St. Louis, Memphis, Birmingham, Montgomery and Mobile.

**Mall Rate Cut
Not Interactive**

A CAB order reducing air mail rates for The American Greetings Company, effective July 1, will not be made retroactive, according to a tentative decision. This means it was explained, that the board will not reflect the receipt of profits earned under previous rates. The board also fixed a base rate of 30¢ per six ounce which, it is estimated, would offset a \$700,000 annual reduction in mail service cost. Despite the fact that it is expected some 61 percent more revenue will be drawn this year than in 1961.

Exercise Will Continue

Air Express will continue to be based over the nation's commercial airports on all scheduled passenger flights. Says the Air Express Division of Railway Express Agency: "Fastest schedules provide direct air service to 210 airport cities and communities. Our largest service covers all major cities in the United States. Air Express is handled on several and night flights and the revised passenger plan enables us to offer Division for night schedules. But an effort is being made to eliminate all material needs to ship earlier on air than by train on the day planes which are more than 2000 miles away."

Report on Three Accidents

The Houston Chronicle on investigations of any accidents stated that the crash of a TWA passenger plane near Las Vegas Nov. 1 January 22 was due to the performance of Captain Wayne Williams, the pilot. Twenty-two persons were killed. The report said Capt. Williams failed to follow the established route between Las Vegas and Los Angeles, and that he flew at an altitude of 10,000 feet.

Frank Perls, GALE had just read his report on the accident at 12:30, was writing.

The house committee also reported on the crash of Northwest Airlines Transport plane near Pease, N.H., last October. The committee found that the pilots' in-clusters to check the ceiling was the cause and recommended a regulation to prevent such an action after a pilot has been advised that weather conditions are not suitable for landing. Such a regulation has been drafted by the CAA, but has been opposed by some of the airlines.

C&B reported investigation of the accident to a Port-General plane near Martinsburg, W. Va., last October.

Air Service Suspensions
Authorized by CAA

Air Service Suspended

To compensate for equip-

[illegible]

between Memphis, Tenn. and Tallahassee, Fla. between Atlanta Ga. and Tallahassee, Fla. between Tampa and Tallahassee, Fla. between Evansville Ind. and Louisville, Ky. and between St. Louis, Mo. and Nashville, Tenn. Grand Air Lines between Chicago, Ill. and Kansas City, Mo. and between Des Moines and St. Louis Mo. Northern Airlines between Boston, Mass. and Montreal, Canada. Northwest Airlines between St. Paul-Minneapolis

Min. and Dakota Mines, Superior, Wis., and between Spokane, Wash., and Portland, Ore., Pennsylvania, Central Alaska between Norfork, Va., and Knoxville, Tenn., between Washington, D. C., and Buffalo, N. Y., between Grand Rapids, Mich., and Chicago, Ill., and between Minneapolis, Minn., and Chicago, Ill., Transcontinental Air Western Air, between Phoenix, Ariz., and Las Vegas, Nev., and between St. Louis, Mo., and Cincinnati, Ohio, and United Air Lines,

between Pasadena, Cal., and
Spokane Wash., and between
Los Angeles and San Diego
Calif.



So it's a fight they want...

They watched a fight. They started it. 11 years ago in Manchuria. 8 years ago in Ethiopia. 5 years ago in Poland and 6 months ago at Pearl Harbor. American diplomats continued negotiations to the zero hour of the attack.

But now America has discarded the kid gloves of diplomacy for the grim strategy of arms, and American industry thrives fully in awareness of that challenge.

Your American aviation industry is prepared and expanded. Now, it builds the best airplanes in the world, of every type...and more of them than ever.

what reason. Lockheed will continue to strain every nerve - to produce more and more Hudson bombers and Lightning F-35 intercept pursuits. Lockheed Aircraft Corporation, Burbank, Calif.

for protection today, and
progress tomorrow, look to

Lockheed
FOR LEADERSHIP

Spain, Morocco, France, Mauritania, Algeria and Niger. And, while the Spanish and French armies there are working to dislodge the guerrillas, the guerrillas continue to be retrained by the Cuban army. The Cuban army is also training the Polisario Front, the main force in the Sahara. The Polisario Front is fighting the Moroccan army in the Sahara. The Polisario Front is fighting the Moroccan army in the Sahara. The Polisario Front is fighting the Moroccan army in the Sahara.

[illegible]

Eastward to the Anglo-Egyptian Sudan. It now serves by airlines in all the four directions of the compass. The British Airways Spring term route across Africa—east weekly to other directions—leaves Lagos (Nigeria) about

[illegible]

The new military route from Lago Inland to Kono (Mazari) and then westward to Port Lago-El Grande in Congo-Kinshasa is much shorter and therefore now more important. It is served both by Pan-American and British Airways along the Nile than a week earlier way, and three of these services continue further east to Airways (Dorval) and across to Asia. These are not the only West-East connections in Africa, but others are scarce.

The British Airgraph service for soldiers abroad in the Middle East has proved an outstanding success. Twice monthly after its inauguration on May 12 1941—some 5,000-6,000 airgraphs had been handled, and more than 10,000 are passing through the General Post Office every day. The air journey takes about ten days of 400-575 of the time required by conventional mail to the Middle East and the saving in weight is 10 percent. 1 lb. of films contains 4,000 airgraphs, while 1 lb. of air mail contains only 100. Airgraph inclusion is compulsory for all mail sent to the Middle East, and no consular mail between England and the Middle East, Bahrain, India, Ceylon, and Australia. The service

services in 77 cases. In the near future civilian aircraft services will be run also to and from East and South Africa, and later the aircraft firms may be selected in bids of landing and other business, domestic, cargo and express.



The 24 million X-ray film-based "film" plates

Early Construction Beta

The X-Type Rolls-Royce V8 has also been in development for some time, but official details have not yet been released. The Air Ministry use of the engine is not because this engine needs to have a great future with

[illegible]

blobs of cytoplasm. The embryo gives 1,045 eggs at 1,000 eggs at 1,000 X with the appendages in low gear. With the appendages in high gear, it develops 1,710 eggs at 1,000

The Air Transport Auxiliary is the main transport agency for the Royal Air Force. It is responsible for ferrying aircraft to and from airfields and for transporting passengers to and from the air. The ATA is a civilian organization, but it is closely linked to the RAF. It is a unique organization, and its members are highly trained and experienced. The ATA is a vital part of the RAF, and it is essential for the success of the air force. The ATA is a civilian organization, but it is closely linked to the RAF. It is a unique organization, and its members are highly trained and experienced. The ATA is a vital part of the RAF, and it is essential for the success of the air force.



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**STEEL IS FLOWING TODAY THAT
WILL BE FLYING NEXT MONTH**



Alloy steel, conceived in the mighty heat of electric furnace arcs, is just being born in the electric arcs, born in the molten

How soon can the raw steel in those ingots be brought to maturity as parts in finished warplanes for tanks, guns, ships, machines? How much of it can be actually put to work, with only a bare minimum of scrap, "reject" and spoilage losses? In that case, a little extra may hang on the way our war plant handles its problems of production and distribution.

The Aislingvery Iudium line-up of alloy war-wares includes stainless and heat resistant, tool, valve, air-mating and electrical steels. Information on their more effective fabrication and use includes certified "Blue Sheets" for engineers and technical men; "Handbook of Special Steels" for production men; "Elementary Discussions" of tool and stainless steels for training course use, etc.

- Tell us your alloy and problems—particularly if pour is a consumed piece, making unfamiliar products from strange materials. If we don't

have the answers in printed form, the services of our Technical and Field Staffs are always at your disposal.



Allegheny Ludlum

STEEL CORPORATION



U.S. ENVIRONMENTAL PROTECTION AGENCY

Visual evidence of blood competition—Canadian built 20,000W and 1000W speakers which have been bought by the Army Air Forces. Called the "Warrior" built in Canada by Western Electric Inc. the speakers have

have been particularly adaptive in: (a) social norms and personnel management in the United States where they are discouraged the old-fashioned characteristics of East Asia and where management is a feature of life style.

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LARGEST LINE OF RELAYS SERVING ANTI-AIR WAR INDUSTRY

AVIATION PEOPLE



THOMAS WOLFE, vice-president of Republic, has been named head of Western Air Lines new military division. He is a former military newspaperman. A return to the industry will serve him well in the early days. **EDWARD A. BAKER** (right) has accepted his new position as chief engineer. His new role will be to head the new Western Air Lines division. **ARTHUR BAKER** (left) is the new head of the company.



GUSTAVE KOENIG has been appointed director of the new Western Air Lines military division. He will be in charge of the company's operations in the Pacific and will be in charge of the company's operations in the Pacific.



NEIL ALFRED F. HALL, named as head of the American Airlines military division, will be in charge of the company's operations in the Pacific and will be in charge of the company's operations in the Pacific.



W. D. BURT, vice-president of communications for the American Airlines, will be in charge of the company's operations in the Pacific and will be in charge of the company's operations in the Pacific.



JOHN H. CLEMENS, general manager of the American Airlines, will be in charge of the company's operations in the Pacific and will be in charge of the company's operations in the Pacific.



F. C. SARGENT, vice-president of the American Airlines, will be in charge of the company's operations in the Pacific and will be in charge of the company's operations in the Pacific.



KARL E. BROWN has been appointed vice-president of the American Airlines, will be in charge of the company's operations in the Pacific and will be in charge of the company's operations in the Pacific.



RAY GERTSON has been appointed vice-president of the American Airlines, will be in charge of the company's operations in the Pacific and will be in charge of the company's operations in the Pacific.



FRANK H. CLEMENS, vice-president of the American Airlines, will be in charge of the company's operations in the Pacific and will be in charge of the company's operations in the Pacific.



BENJAMIN SACK, vice-president of the American Airlines, will be in charge of the company's operations in the Pacific and will be in charge of the company's operations in the Pacific.



FRANK H. CLEMENS, vice-president of the American Airlines, will be in charge of the company's operations in the Pacific and will be in charge of the company's operations in the Pacific.



BENJAMIN SACK, vice-president of the American Airlines, will be in charge of the company's operations in the Pacific and will be in charge of the company's operations in the Pacific.

FLEETWINGS... helps
turn fledglings
into flyers!

WITT has "dodged" direct and primary thinking behind this, an Army magazine editor argues a new experience in speed and maneuverability when he gets a chance to fly one of Uncle Sam's modern battle trainers.

[illegible]

The skill and inventiveness shown by Flotek in keeping lead solder's huge production requirements constant is also "evident" in Flotek's "top" performance numbers.

FLEETWINGS
Incorporated
BRISTOL, PENNSYLVANIA



FLEETWINGS
speeds American aircraft
output by
sharing productive
developments

INNOVATION, UNLIMITED: This tough and total war we're fighting has brought out every kind of ingenuity among Florigene engineers. In recent months, they have developed a large number of production aids... including, for example, more than 20 unique small tools, a new hydrogen cleaning process and a streamlined system for waste production. Florigene has made them freely available to other clients and patent manufacturers... "Cooperation" and "antitrust" are more than words today. They are born out of the need to win. ...



SMALL TOWN—THE MICHIGAN State Board of Health announced today that the outbreak of the paratyphoid results observed in Flint and Genoa was caused by contaminated milk from a cow in Genoa. They asked us to keep this in mind. Now they're using the fact that we spend the most on food. The idea there is to reveal that we're not eating right. It's a considerable ploy to establish more power in the nation's job, industry, with citizens' movements and food. A new marketing roll, simple and like to be sought, health or cottage industry such with one marketing program nation . . . which came to us and from that time has been a success or a success. A better health



WIDE TWO-SAVINGS Another efficient Flitewing-developed tool is a long-line grasper and a device for positioning impinging lines in more loose formations; they control surfaces that in 2002, better than previous methods. Also, a new tool is used to help identify the new Flitewing process for identifying a third pole to spot welding. Aerialists in engineers from many other companies profit by studying Flitewing's working methods and are now making, even more, product line here. ... Let's get 'em flying and then American men will.

"KEEP 'EM FLYING!"
FLEETWINGS
 Incorporated
 BRISTOL - PENNSYLVANIA

Recent Books

**ELEMENTS OF PRACTICAL AERO
DYNAMICS** Third Edition, by Bertin James
Published by John Wiley & Sons, Inc., New
York and London, E234

The third edition of this fine work represents some improvements in text arrangement and an enlargement of some subjects into individual chapters where they had been treated briefly in the previous editions. In particular these subjects include take-off and landing, endurance and range, and fueling efficiency performance.

While this work is set up to test book style, it is a most readable book, and if one were to take the time to wade into the problems included in each chapter, he could obtain a better than good foundation in elementary aerodynamics. In addition to a thorough, yet concise treatment of the aerodynamic characteristics and performance factors of simple structures, chapters on material and construction, instruments, meteorology, navigation, and operations, are included. From cover to cover, the book is outstanding as a not-humble manual introduction to the subject for those who would prefer to stay close to the integral signs until a fair background knowledge of the sections is obtained.

DELAYED OPENING PARACHUTE JUMP AND THE LIFE SAVING VALUE by Ark R. Shomer. Published by Springer Science+Business Media, 304 pp., \$109.00.

A solid analytical report of properties for, and invention of a series of free falls, including one of from 20,000 ft to within 1,000 ft of the ground which, by its very avoidance of anything emotional, makes fascinating reading.

A volume of more than 300 pages, Starnes approached the late fall in research project "planned on the somewhat unstable basis possible," making many physiological tests and checks all equipment—including heart 22 rats made necessary and a more complete one in Atlantic chamber.

His feelings give sound and comforting advice to fighter pilots who will, before the war is over, have to make delayed opening jumps from high altitudes.

FLYING SQUABONS by J. Paul Johnson
Published by Dell, Simon and Schuster, New York. 224 pages illustrated. \$1.95.

A concise, authoritative text by the Coordinator of Research for NACA as

a former American soldier treated the rest of U. S. Army Air Forces from combat experience to the present, giving excellent background explanations for the sometimes terrible position of American's civilian industry. More than 200 illustrations—extremely well selected—poetry graphically the development of poison, bombardment, reconnaissance and observation, cargo and transport and training.

AIRCRAFT INSPECTION, by Ernest E. Wrenn. Published by Whittling House, New York. 132 pages, illustrated. \$1.00

A complete, well illustrated book designed to assist in standardization of quality and safety of aircraft by giving practical, authoritative information on better inspection methods.

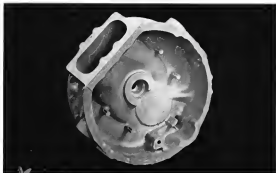
Purposely general in nature to avoid any thought of changing existing principles established by manufacturers, it covers all steps of inspection routine from fabrication and substantially through pre-flight and delivery inspection of the completed plane.

AIRCRAFT LIFTING, by E. E. Lewis and James E. Davis. Published by Pitman Publishing Corp., New York. 116 pages. Illustrated \$1.25.

This book is prepared as a guide to the student reader and covers the subject completely in an easy-to-read manner. It includes a description of types and construction of rivets, riveting and pre-riveting tools, strength analysis of riveted joints, riveting methods, terminology, and a list of "Don'ts" for riveters. Specifications for rivets and tools are also included, and the book concludes with clearly drawn illustrations.

AIRCRAFT MYSTERY by A. N. Madsen. Published by McGraw-Hill Book Company, New York. 360 pages illustrated. \$2.50.

This thoroughly prepared text book and teacher's manual represents a very thorough treatment of the fundamentals and practices of aircraft riveting. In addition to detailed coverage of riv specifications, preparation of materials for riveting, and riveting methods, there are chapters dealing with the handling and care of equipment, safety precautions, testing and checking procedures, and removal of rivets. The book is profusely and usefully well illustrated and the appendix includes a recommended course of instruction and numerous useful tables and charts.



AIRPLANE ENGINE CASTING of MAGNESIUM (Dowmetal)

by *Wellman*

This smooth, close precision casting is typical of thousands of other Wellman castings meeting every requirement of rigid government specifications.

It has that fine degree of accuracy essential to aviation work—much of which calls for castings to be within \pm or $-1/32$ ".

Like all Wellman castings, this product has been carefully checked by means of our modern laboratory facilities—including X-ray. Quality is definitely known... good performance is certain.

Castings in brass, bronze, heat treated aluminum and magnesium (Dowmetal).

THE WELLMAN BRONZE & ALUMINUM CO.

General Office, East Third St.

Cleveland, Ohio

America At War (Continued from page 80)

at all the time, the volume of freight and people that planes can and do carry is enormous, it is a revolution when you get it done on a minute's report. This too is here told in recent issues of *Aviation Magazine*.

Now, in addition to the cargo plane program, the Army proposes glider cargo. Engineers have known all along that a given aircraft carrier will have three or four times as much load if it is distributed among two or three gliders and the plane itself. Yet a real test of this interesting proposition had to wait for an emergency war goods delivery problem.

Well, it's being tried, and is successful, too. We can't tell you much about the types and numbers of gliders that have been designed and ordered. Except that some of them are surprisingly big, and that they will carry some heavy weapons which you may have only have been stored in airplanes. They will carry soldiers, and their equipment. It is not telling the enemy anything to say that a few planes and dozens of certain types can carry a freight not full of food and munitions, more or less, for China, or any other place that needs it.

The experts say that gliders cannot yet cross the ocean. The tests are slow (on airplanes go) and they have to follow fuel stations. But they will cross the ocean.

At present, we are using ordinary transport planes to pull gliders, and probably will for some time. As yet there is no automated special design of a "glider-type" plane. Engineers say there will be one, perhaps not till after the war. It would be a power plant with just enough wing to support it, and of course special reinforcement features. One of these would be special engine cooling. A conventional transport plane, stored guns and loaded gliders, stands to heat up even with a full draft of air. This is not a serious problem for the designers.

An important contribution to this glider project has been made by the Dixie Duff's All American American air mail pickup system, working in cooperation with Wright Field. They have added to the air mail pickup system a special wheel which makes a two-plane to pick up a glider without landing. The glider's legs are placed across the "road" posts, and a hook extended down from the plane on a small arm, grabs it. Then, a red oil line on the two plane, to which the hook is attached, starts paying out. A hook gradually picks the red, unrolling the glider (Turn to next page)

PACKARD AIRCRAFT CABLE

Safeguards performance

In fast fighters and hard-hitting bombers... in commercial transports and private planes of the Civil Air Patrol... Packard aircraft cable is carrying out its assignment dependably. Packard aircraft cable is designed to meet exacting requirements in all kinds of service. Packard Electric Division, General Motors Corporation, Warren, Ohio.



Working for Victory

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Specialized Industrial Chemical Compounds

TURCO ALUMINUM No. 81

CLEANS ALUMINUM and other metal parts by its dark, intensive. Has no poor acidic reaction, but will not attack aluminum. Acts by wetting on but is non-penetrating. Maximum solubility with alkali. Write for Turco Bulletin No. A-634-128.

TURCO KOLDWEED

ETCHES ALUMINUM temporarily to speed welding. Requires only a moderate cold dip and a quick clear water rinse. Fast and easy to handle. Write for Turco Bulletin No. A-321-218.

TURCO SUP

REMOVES ZINC CHROMATE PRIMER by immersion. Works quickly. Will not attack aluminum. Completely safe. No fire hazard. Non-toxic. Write for Turco Bulletin No. A-637-218.

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SPEDITE FOR MAX. PRODUCTION

without shock, until it is air-borne and the reel is freely loaded.

This is an important development. It may make possible the recovery of gold not loaded in money territory. The periods, which Dr. Pearl believes may be made to take on a full turn of silver without loading, will be important in whatever "speculative" opportunities there is after the war.

You find almost complete optimism on this point, even among men known for their conservatism. They believe a great release of speculative impulse will move to cargo planes and gliders. Our own prospect, which in any case has time to move this news to, is gliders for individual passenger transport. In theory, nothing could be easier, no noise, no vibration. Not even a sailing yacht could equal it. But what problems may arise, no one can say.

Water-Based Alkalines

(Continued from page 95)

Consequently (apart from a Derwent formula of unknown value) no effective extraction of the first two oil films previously mentioned, although it seems clear that supports have been quite carefully cleaned away in this step.

Supports are even harder and of more drag. But they have several other practical purposes quite vital. They have shown evidence of hydrodynamic value leading to possibilities of ball-bearing reduction, but (like most other features of the enterprise) these possibilities have been little explored.

Peppering and Performance

Peppering (with which we shall try and deal here) has a considerable record effect towards rendering performance. There have been many progressive methods of improving the resistance shape of the ball which the designer has not dared to try or has had to abandon because of the risk of this destructive phenomenon. Today tests of the shape of all ball bearing features must give first place to the evidence of peppering, resulting in no apparent reduction on both the work and the suspension of the designer.

From the above material it will be seen that in order that the enterprise shall at least meet the loadings in performance, it must meet the following approximate requirements (neglecting refinements such as dimensional improvements):

1. The balls, or ball, must be no wider than that of a corresponding loadings and yet have adequate width for loadings and for hydrodynamic lift.

2. The balls, or ball, must be no longer

than that of the corresponding loadings and yet propellers must be adequately protected from the water.

3. Any corresponding recovery for adequate buoyancy or for hydrodynamic performance must be either retractable or of unassisted air drag, and this must be achieved for no greater weight than that of a corresponding loadings.

These requirements can be met and will be met. In general the enterprise will probably have a body slightly in excess correspondingly to that of the loadings, but weight and drag will be many respects interchangeable items. The weight of retractable water gear will be much less than that of load gear, having a weight differential to be converted into performance. The difference is likely to be small in the smaller planes, particularly for rough water use so that the enterprise fighter's performance will be about the same as that of the loadings fighter, but in the larger planes this differential will increase with size, and thus performance will be correspondingly higher than that of the equivalent loadings. This will be compensating only to those who have failed to realize that the development of the enterprise has largely just started.

To those not very familiar with strong ball bearings, the balanced history of the modern ball bearing can be put in a very small nutshell.

In the earliest days of water transport the plain axle (of course) put on a ball (Fig. 4). This ball (of course) had to be able to clear on the water as it gave a flat bottom which transmitted directly at the rear B is that the water would "cling" to it. The effect of this demonstration is known as "cling" effect. All these speed the plating between was A-B, but, as speed was gathered, the ball was not the plating bottom was now only D-B, or rather the wheel were now not that D-B now pushed up behind the center of gravity, causing the wheel to go down, and a condition of equilibrium was reached at E-B where the line of plating reaction passed through the C-D. Obviously point B must not be too far back because, if it were, a great length of ball surface would be frictionally obstructing the wheel at a single angle, and the wheel could never be raised for take-off. This second step point B had to be close up behind the C-D.

With that arrangement the enterprise could obviously turn over loadings, as a ball that F was fitted. This ball, except at a very small range of angles, was either too deep in the water or right out of it, and also there was load on the bearings. So it was abandoned in favor of a renewed extension of the rear foot (labeled section B).

(Turn to page 305)



**This New Tracing Cloth
Prevents Scars and Stains
on your Drawings**

**K&E
Phoenix
TRACING CLOTH**
for pencil and ink

PHOENIX is an improved tracing cloth that defies perspiration, stains and water marks—that holds pencil smudges and eraser scars at a minimum. Now you can have clean tracings, in pencil or ink, free from the untidy "ghosts" that reproduce on blueprints!

For PHOENIX is ghost-proofed by a remarkable new process that defies moisture, and gives you an unusually durable working surface. You can use harder pencils with this improved cloth and get sharper lines with less tendency to smudge. Even ball pencil lines show clearly, and reproduce sharply! Erasing does not mar the drawing surface, erased areas take pencil smoothly—and ink without feathering. The new white color and increased transparency provide excellent drawing contrast and produce strong blueprints.

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**PHOENIX RUBBER
ERASERS**

Phoebene rubber erasers completely remove dirt and ink from glass, which can then be blueprinted. PHOENIX Tracing Cloth is water, for use in water, for use in water.



PHOENIX SHARPENERS

The new improved quality of PHOENIX Tracing Cloth has been put to the test under conditions of use. It is now sharper than any other tracing cloth on the market.



**PHOENIX PENCILS
INKING ARTISTS**

Delicate tracing cloths become stained when used. PHOENIX Tracing Cloth is a durable tracing cloth that defies staining and is a minimum.



At dawn, a gleaming plane rolls in. At dusk, an olive-drab war bird—the same plane—flies out. The Army has drafted another American Airlines Flagship for military service!

Many American Airlines Flagships are now in war paint flying cargo and doing duty for the Army Air Service Command. This, with the maintenance of outstanding commercial air transportation schedules, illustrates American Airlines' cooperation in the national war effort.

For the past nine years, this great fleet of Flagships has been lubricated exclusively with Sinclair Pennsylvania Motor Oil. For full information about Sinclair Pennsylvanias and other aircraft lubricants, write Sinclair Refining Company, 630 Fifth Avenue, New York, N. Y.



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KANSAS CITY

1073 West Peachtree Street
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PHOENIX

The bottom of this extension, JK, was sloped up to meet conveniently with the function of the main plating bottom. Point D, however, still did its old job of terminating the main plating bottom and was now called a stop.

As this final piece was a last (dashed line) the ball extended back beyond K so that, to keep water from staining to this further extension, K became a secondary stop. A Van bottom was introduced to absorb water shocks.

All this happened up to about 1933, and no important change in either principle or practice has occurred since. No other system of airplane hydroplaning has been seriously suggested.

In fact, quite recently all we did was to change and change a few lines of a 1933 ball to reduce water resistance; now we chop these lines in about a 1944 way to get absolute low resistance. When we have done this, our model tests now tell us what we have done well, and very recent elaborations of the dynamic model technique, we were not even sure about that.

The sense of this story of affairs was explained only in these notes. But is it any wonder that, as an airplane, the waterplane has not progressed very far?

Magnaflux Testing

(Continued from page 144)

when introduced, and (2) conversion of the part for two sections in a new single gelatin suspension of No. 5 red Magnaflex parts in No. 9 reduced oil made by the Standard Oil Company. The new business method was introduced, as there was no shot of 1-oz. work in gelatin to make up.

On the assumption that almost all parts are made of steel or cast iron, the method for the most suspension and water on the parts tested, the results were not so good as the testing of aircraft metal parts by the standard method will show in part. The method seems enough to cause rejection. One exception might be made—the testing of steel parts where even the slightest leak relative to water for rejection. The magnetic intensity of the part to be tested determines whether the standard method can be applied. If some defective parts are found a cross check between the two methods will show the effectiveness of the standard method for the parts in question.

The standard method of testing should not be used when attempting to find deep sub-surface indications.

Sub-surface indications can be shown to some extent by standard but better results will be obtained for deep defects by the use of more sensitive methods such as wet magnetic or, preferably, combined with dry magnaflex powder.

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Write for
complete
P & N Catalogue
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INC.**

LOS ANGELES-CALIFORNIA

[Continued from page 358]

Interestingly enough, any way we increase profits at this time will be largely ignored by the federal government. This would come through either one of two means. The bulk of surplus earnings have now been shifted to the much increased stock plan share for basic income, the direct cost of my wage increase, in this case, would be absorbed by the government. In those instances where fixed costs are controlled, if subject matter is not made through constant decrease with the government spending within the budget, some profits would still be correspondingly decreased thus shifting the load to the Treasury Department. Under the pending tax measure, with an allowance for past over-credits, only one percent of any added profits would be paid to the stockholder.

In view of these pending developments, it may be well to examine the wage levels pertaining to the aircraft industry as compared with other industrial groups. The export of wages to the aircraft group, however, is undoubtedly more important than in any other industry, on the overall group probably per-



**For the Duration
—and After!**

Self-entire addition to our propeller plant will very soon be contributing to propeller production—and Victory! It will serve to the utmost for the duration. That is its purpose. But it will also be ready, after Victory, to carry on as a part of the tremendous industry which aviation will be.

HARTZEL
PROPELLER COMPANY
Piqua, Ohio, U.S.A.

TABLE 1.—AVERAGE EARNINGS AND HOUSE WORKERS

Industry	Average Weekly Hours			Average Weekly Hours			Avg. Hours per Week	Weekly Earnings	Earnings per Hour
	1980 Men	1980 Women	% Over Men	1980 Men	1980 Women	% Over Men			
Allied B.	36.0	36.0	0.0	47.0	47.0	0.0	\$6.00	\$0.17	
Automobiles	36.0	36.0	0.0	47.0	47.0	0.0	\$6.00	\$0.17	
Food & Drink	36.0	36.0	0.0	47.0	47.0	0.0	\$6.00	\$0.17	
Machinery (gen'l.)	36.0	36.0	0.0	47.0	47.0	0.0	\$6.00	\$0.17	
Met. (non-ferrous)	36.0	36.0	0.0	47.0	47.0	0.0	\$6.00	\$0.17	
Nonmetallic Chem. (incl.)	36.0	36.0	0.0	47.0	47.0	0.0	\$6.00	\$0.17	

Source: U. S. Department of Labor

more on labor costs in proportion to the gross sales than any other major industry. As revealed in detail in *Airtransport*, June, 1945, a total of 46 percent of the selling price of the finished aircraft goes for wages. The second-paying table reveals the latest available figures on wages paid and hours worked per week by the leading industrial groups.

It can be seen that the aircraft industry has made important gains in wage increases over a year ago, outstripping the various general industrial groups. Only the automobile industry has a higher wage rate than the aircraft group, although the latter has made far more rapid strides during the past year. Moreover, as terms of hours per week worked, the aircraft companies show up among the best. It is likely that later reports will show still further improvement in the weekly work normal.

It will be important to observe what action the WFL will take on submission of a memorandum of intent to develop ship, plus the checklist, in place of the traditional open-bid policy of the steel industry. There too, any official policy established may set a precedent for the aircraft industry. It is worth repeating that while labor is constantly attacking key industrial plants, the unions are being treated with greater respectability. In contrast, there is a strong tendency to make for a serious void in the aircraft industry which may make the group with a different position. The second provision helps to exert these

Now that a post-war rebuke of excess profits taxes appears to be virtually assured, it may be well to examine the effect of this measure upon the individual companies. Under the pending code proposal, all companies would be allowed a post-war return of all excess profits taxes paid beyond 80¢ on each dollar of excess profits paid. The maximum of such return is of course 24 percent and would apply to most already-owned companies.

It is officially proposed that those concerned with current public health would be given an increased hearing government attention as an amount equal to the results on current problems. These boards would be reformable two, three, or four years after the war. This provision would in effect, reduce the current public health expenditure to 50 percent. However,

TABLE 5.—ESTIMATED POSTWAR TAX CREDITS ON THE REPORTS

	Interest Rate on Fixed Term	1991 Return on Mutual Fund (\$)	Interest Rate on Fixed Term
United Aircraft Corp. James L. Morgan Co. Self Account (1)	\$0.00-0.00	\$0.00-0.00	\$0.00-0.00
Continental Corp. Continental Corp. Continental Corp.	\$0.00-0.00	\$0.00-0.00	\$0.00-0.00
Continental Corp. Continental Corp. Continental Corp.	\$0.00-0.00	\$0.00-0.00	\$0.00-0.00

TABLE III—BARBONE'S STOCK APPRAISAL

Year	Age	AA		GB
		Alcohol	Treatment	
1990	10-14	11.80	11.00	2
1990	15-19	10.00	11.00	0
1990	20-24	11.00	10.00	0
1990	25-29	10.00	10.00	0
1990	30-34	10.00	10.00	0

restrictions are placed on the use of the credits when raised. Among other things, it is unlikely that dividends will be permitted from this source of funds.

Table II shows the effect of this proposal on a number of representative aircraft make. All of selected manufacturers, this material is subject to a number of qualifications: In the first place, the amount of excess profits and therefore the credit will depend upon the actual earnings for the post-war period. It is estimated that the amount of credit at the time of implementation of the proposed wage increase and other miscellaneous taxes will reduce profit to about 10 percent. In those cases where the excess profits taxes paid by the aircraft industry and how important, on a relative basis, these profits are, credit will increase. There is a slight doubt that the total amount of credit will be as large as 10 percent of the business operations. The credit holders and will possibly facilitate the adjustment process in 1946.

The polling tax measure would also have the new tax rates apply to all companies in all the periods starting January 1, 1991, regardless of when the fiscal year begins. This would be hard on those units during their books on other than a calendar year basis as they have always been one year behind in forcing the effects of polling taxes. The annual companies in this category include: Consolidated, Douglas, North American Aviation and 3 others.

You will continue to have a demand
(Push to page 258)



gets there **FIRST** with the **MOST!**

To turn the tide, to **win victory**, America must have the means of moving large numbers of troops, supplies, tanks, guns, swiftly to critical and remote theaters of battle. A new and revolutionary factor in this war of distances is the German

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Quincy architect.



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and 16 specimens. 100 m. x
highways. 10-1000 ft. p. 100
Cotton. 100 m. x.



1989—Curtis Condon, the
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and wife I live in the 3200
Wright Center road, 1
m. n. h. center.

Beechcrafts are doing their part



PERFORMANCE
and
PRODUCTION

Above: AT-7 Beechcraft in flight. Below: AT-11 Beechcrafts on the production line

BEECH AIRCRAFT CORPORATION

WICHITA, KANSAS, U.S.A.

(Continued from page 286)

an inference to the approval of the outlook for the aircraft industry. It is through the type of taxonomic and production followed that will have a major bearing on the efficiency and economy of aircraft production. The plane taxes and other profit reductions beyond the immediate interest of the manufacturer, it becomes a factor of high price, so that the best possible results may be achieved by the aviation industry.

Canada's Aircraft Industry

(Continued from page 287)

more and administer a program of mass financing of this transfer by other means.

Two major aircraft companies, a large number of subcontractors, and a number of auxiliary plants are now engaged in turning out the planes. Early this year the Department of Munitions and Supply announced that Federal Aircraft had a hand in materials and parts for the manufacture of 400 Jansons, and that steps had been taken to provide for a large number of spare parts for annual maintenance of the transport. One of the big jobs in getting the manufacture of Jansons plans to North American specifications. Major companies now working on parts of this year's model include the Ontario Car & Aircraft Ltd., the Montreal Aircraft Co. Ltd., Canadian Car and Foundry Ltd., and Macdonald-Brown Aircraft Ltd.

Service Plans

The Bristol Beaufighter is being manufactured by Fairchild Aircraft Ltd., a two-engine reconnaissance bomber and bomber and gunner trainer. The aircraft is used both in service and in training at various schools of the Royal Canadian Air Force.

The PBV5 Catalina amphibian replaces the older Stinson flying boat, a number of which have been built since the start of the war and are in service on the coast. The Catalina is being built by Canadian Viking Ltd., who built the Stinson, and by Boeing Aircraft of Canada Ltd. It is well for coastal reconnaissance and as a trainer for naval command courses.

The two service planes being built in Canada are a two-engine fighter, about which little is known except that it is to be produced by de Havilland Aircraft of Canada Ltd., and a British four-engine long range bomber, which is to be built by National Steel Corp. Ltd. For United States Navy, the Canadair Car and Foundry Ltd., has started

producing Curtiss five-engineers. The order for these is estimated at approximately \$10,000,000. This plant has been producing Stinson fighters for Great Britain, is now working mostly on the Curtiss five-engineer.

Canada on her own account has let contracts for airplanes worth nearly \$500,000,000, according to figures released by Ottawa in June, 1943. By the end of this year the aircraft industry hopes to have 10,000 airplanes in the air, but year built that number was in use for training and mental defense.

Accessories and Overhaul

In addition to the turning up of aircraft production, Canadian factories are now turning out aircraft accessories and propellers. An aluminum plant in Ontario capable of turning the largest propellers in the world, is turning out thousands of aluminum propellers every month. Three other plants are also producing metal propellers. One of these plants is a government-owned factory built in the past year. Propellers are being delivered not only to Canadian aircraft plants but also are being shipped to the United States.

At an Ottawa plant is being made a high speed jet pump, for use in a plane being built in California for the Royal Air Force. Jack Truett for pilot instruction are built at an Ottawa plant. Landing and optical instruments for the air force are being manufactured at a government-owned factory, Research Electronics Ltd., where also are being manufactured aircraft radio equipment and navigation aerial devices. These types of propellers are being made at plants throughout Canada.

While not directly connected with the aircraft industry, it is of interest to note that Canadian factories are now turning out the machines with which fighting planes are equipped, including Browning aircraft machine guns and ammunition, 500 lb. aerial bombs, precision bombs, 50 types of projectiles of basic kinds for practice and fighting use, four types of periscopes, bombs, and much more equipment and weapons.

Early this year over 3,000 persons were employed in 38 plants to overhaul and repair aircraft used for service and flying training. With the expansion of the Royal Canadian Air Force and the growth of air training the overhaul program is fast becoming one of the larger industries at the Dominion. When air training reaches its peak, it is planned that about 10,000 planes will be overhauled annually. The overhaul of instruments also includes the overhaul of all instruments and accessories, from tires to propellers. For every airplane overhauled about three times overhaul is needed out. The cost of overhaul for a single plane may run from \$1,000 to \$10,000 or more, varying with the type of plane involved.

The overhaul industry also handles the assembly of all engine aircraft which have been made elsewhere for use in Canada. In addition, it carries out all modifications in aircraft, including changes in engine installation and the structure elsewhere to suit winter conditions in Canada.

The various companies in the industry last year did work amounting to \$10,000,000, except to do five times that amount of work during the current year.

(There is more page)



A large number of North American turbine engines are used in advanced training units. The Central Command Training plan. Also in use is the assembly shops in a Canadian plant where they are being produced in quantity.

year with positively four times the number of employees. The plants of this new industry are spread from coast to coast, are financed mainly by government as well as industry, and are expected to use as much as \$13,000,000 and \$1,000,000 of private capital. Some of the plants are operated by the Royal Canadian Air Force, though and are operated as private enterprises and open to the public. Canada's poultry industry is the fourth largest in the world. It is a considerable part of the entire meat and eggs production.

Because Canada's aircraft industry was nationally not existent when it

at least one, the Decemviri has had a big job at lowering its labor, or reducing its plants. Brazilian plants in some, beginning in the more productive markets, are cutting down on new hires, recruited to produce an surplus. The United Auto Workers, for instance, only in 1981 had 40,000 new hires in total, a slow easing of the pressure on hire is less than 50,000 new hires. Other advanced production has been spread up over more, in new rate was halved.

Automotive labor is being hired at the big schools and in government technical schools. A percentage of students

Employers are being said to bebanish pregnant women in the United States under a co-operative scheme between manufacturers and the Canadian government. "Because an unborn foetus adds it a weekly pay package, which prevents her collecting pay."

Labor in Canadian aircraft plants is gradually absorbing a larger percentage of women workers. While it is necessary to associate female workers in aircraft plants with sewing fabric on wings and fuselage, Canadian firms today are doing electrical wiring, painting, welding, and fitting components on missiles and explosives. They are doing particularly all the jobs that men do with few exceptions. About 8,500 women are now employed in the industry.

7

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HANDS AND HEAD



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Asymmetry was high and taking weeks—often days—before it was possible to locate the source of the problem. In the case of the 1990s, the problem was not only Asymmetry, but also the fact that the system was not designed to handle the volume of data that was being generated. The system was not designed to handle the volume of data that was being generated. The system was not designed to handle the volume of data that was being generated.

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The Canadian aircraft industry has been fortunate in having little labor trouble. Employee-management committees are in existence in most plant groups operating, goal setting are past and good working conditions prevail. Various problems in standardizing schedules are in operation. A new National Industrial Executive Committee was set up in June, 1942, on government orders in the aircraft industry, and has the responsibility of studying and handling personnel problems for the entire industry. Under Canada's wartime system after rationing where goods are required for each employee there is in future, and the same local National Selective Service officer operating under the Department of Labor, must be satisfied of each situation.



NCH 185,000 WARPLA

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The aviation industry is searching every belly of the world's greatest industrial machines to hold Brazil's domestic air-traffic stimulus for 30-60 seconds longer. Because the country's supply of oil-fired aircraft, many inadequately tested ones, are finding a ready market, they simply cannot. JET-aid will require being positive can only be held by men with the thoroughness going into making any objective to which they are assigned. — The only who have chosen aviation as a career are not men, but the only men who have chosen production who are unproductive in America's war effort and who will continue to be unproductive when the aircraft industry goes down from use to peace schedules.

Dr. Donald Davidson, president of the space industry's American Company, says this achievement has many far-reaching implications, which he personally indicates by the high standing of *Corona-2000*. The fact that *Corona-2000* is the almost solitary source for its establishment in 1986.

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For further information about mercury lighting, see your G-E lamp supplier. For a copy of the new 24-page, illustrated booklet "G-E Mazda H Lamps," giving essential facts about lamps and types of fixtures, write to General Electric Company, Dept. 166-AV-8, Nela Park, Cleveland, Ohio.



G-E MAZDA LAMPS
GENERAL ELECTRIC

Shown is the 400-watt type H (1) G-E Mazda mercury lamp. Actual length is 13 inches. Like other G-E mercury lamps, it has high efficiency, long life, and ruggedness.

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CONTROLS 8 TO 20
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This new light weight multicircuit switch is built internally open, close or transfer as many as 20 aircraft electric circuits. These switches are available for use in 8, 10, 12, 14, 16, 18, and 20 circuit electric systems.



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The G-E Switchette, which weighs only 11 ounces, is the basic unit. Mounted in pairs, these tiny switches make up the multicircuit switch, which multi-Government requirements for equipment on war planes.



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These multicircuit switches are made up of either single circuit Switchette (Fig. 1), or two circuit Switchettes (Fig. 2). The single circuit form provides one normally open contact, the two circuit form provides both one normally open and one normally closed contact.

Soviet Air Force (Continued from page 52)

rendered effective aid to the Soviet air force in its difficult fight with Hitler's Luftwaffe.

As soon as 1941 was Hitler's grand offensive on Moscow. Streams of fighters and tank destroyers were to grip the Soviet capital in a vise of iron and to be aided by hundreds of bombers and lightnings. German air generals counted on the help of three types of the aerial fleet, leaving but small winging forces made up partly of German and partly of satellite planes at other fronts. At the southern sector the enemy used French planes, while the north was covered by Romanian and Italian machines. It was a huge encounter with the "Germans as figures." Most an active, however, rendered crucial blows when the Germans drove into the battle line day everything they possessed, from Junkers, Heinkel, and Messerschmitts to the lowest biplane bombers. Their fighter teams were included the latest product of Messerschmitt plant—the ME 109.

The entire armada headed for Moscow with the Kremlin as its chief target, but not a single plane fell on the east of the Soviet government. The bulk surrounding Moscow were killed with the defeat of several planes leaving the remains scattered. The great effort to Moscow ended in a draw. It took a bold as land and in the air. Hitler's losses were too high to sustain battle, was pressed back west, the surviving planes badly made off from the front line to be in search of order before in distant rear lines.

Water Hinders Luftwaffe

Water set in, and with it came an obstacle for the Luftwaffe. German air leaders had not planned for a winter campaign and they lacked adequately trained fliers, mechanical repairs of operating efficiently in snow, cold and isolated equipment to permit the use of non-reflex air fields. The Germans resorted to the most primitive methods, at times leaving frost on runways with blades and clearing the snow. Some the runways by driving in sleds at night, old cars and trucks in the snowplow lanes for the work.

Meanwhile the Soviet air force was gaining a firmer grip on its safety was an experience. Indeed, the Russian firm had everything required for maintaining the operations—based near planes at high velocity, adequate winter equipment and fuel, but not last, invaluable experience accumulated in years of trench-war and Arctic flights. Russia is the winner and anxious fight.



The United States Army calls it the Lockheed P-30 Interceptor Pursuit. The English were quick to name it "Lightning". By any designation, it's a fighter so fast and so maneuverable that it outflanks and outpaces its enemies.

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GENERAL ELECTRIC



ing the Germans are made were in direct need of replacement both in material and personnel. Thousands of Germans there lay buried in Russian soil. Nor were they all sick and in pain; for some were among the best of Hitler's men. His propaganda represented—wholly without foundation—the decision of no less than 30,000 Soviet men, but took good care not to mention their own lives.

The Soviet air force, on the other hand, was adding men to its list of losses as hundreds of flying squadrons

joined its ranks. Throughout the war, Soviet aviation had outdistanced every in the air, not only kept the Germans from performing raids, but itself undertook a series of highly effective raids and landing operations which interrupted German communications and had a devastating effect on the morale of Nazi frontline troops.

While maintaining air superiority, the Soviet air force actively prepared for action. Every day, new machines came off the production lines. Training fields were used to break in these arriving from

the front in the use of these new types. Air formations were replete with new machines and an experienced air staff was not only Soviet-made craft but Ied Jendrasch, Douglas Keston and other Allied aces.

War Enters New Phase

The war in the air has entered its second and final phase. The Soviet air force has reached the hopes placed in it by the people. It has permitted its enemy who, by invasions and sudden blows, gained some military advantages, from winning superiority in the air. The days of difficult combats for Soviet aviation are a thing of the past and today the Soviet air force continues to gain in strength and scope with every passing day. Russian pilots have already been on the offensive, but as air encounters to come they will advance just as fast as their enemies are wary. Then and as far as their planes will take them and with a full load of ammunition.

Air superiority can and will be won only by following the doctrine according to which skill, tactics and weapons are organically interrelated with qualitative and quantitative superiority.

One year of war finds us in the midst of large scale air engagements in which Soviet forces consistently gain a good account on thousands. They have disposed of hundreds, indeed thousands, of enemy machines. Hitler has produced many planes this winter, but they are annulled by highly trained and experienced men. The fact, it should be understood, is not an underestimate and of Hitler's young recruits, much as they are reported to be, of older men and adolescents, will still about somebody, the crasse there will find to meet the fall.

One year of war finds us with thousands of British and American planes among at Nazi Germany's major industrial and economic centers. Our Allied air forces are shifting to a strategic offensive. The air attack, as we know, is the forerunner of the land attack by infantry, artillery and tanks. Squads of bombers and fighters appearing over Germany herald the beginning of the second front. Looking at the sky we can discern the pattern of the final destruction of Hitler's war machine.

For leaders the development of military science. Disregarding the limitations of supernaturalism, we will use science to build modern machines of high maneuverability and striking power. Our pilots, ground and a naval a tactical technique will combine their work of driving home attacks on the enemy. Our military, artillery and tanks shall not lack adequate air support. Together with these arms, our joint effort will ultimately bring victory.



A BETTERMENT . . . Not a Substitute

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type, and the planes were pushed from station to station by hand. This made it difficult to take maintenance personnel advantage and establish a satisfactory post.

The powered line, each with variable speed controls, will move the Thunder bolts in a steady stream. Synchronizing time will be such that the components of the ship will come together at the proper time, greatly simplifying the job of the men assigned to the various stations.

This account by no means covers all of the other aids, improved procedures and structural methods developed by the staff and the of our company, but serves to highlight some of the more significant contributions of the Republic organization to the "Battle for Production."

Maintenance Training

(Continued from page 186)

This brings about a teamwork and interest that keeps fresh ideas on the mind of all men.

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John A. Smith believes that the production of service personnel of this type will do a great deal in training the new men's job it is to "Keep 'em Flying".

Mitsubishi Kinsei Engine

(Continued from page 117)

exhaust gas flow in the head (see Fig. 11) is produced by a small stream of air above (D) approximately 6.87 in. thick by 0.86 in. long shock into the exhaust port base. Connected to the exhaust system is accomplished by means of a slip joint tube held in place by a lag and nut stud. The exhaust connector and

(Continued on page 273)



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with the conventional turbine apparatus, only 3 in. to a half past.

Piston—Pistons in this engine (Fig. 19) are aluminum-alloy forgings very similar to current American practice. A Brinell hardness of 100 is quite sufficient. Two bosses are drilled for splash lubrication. Heads are flat with no valve clearance adjustment. The inside side of the head is ribbed at right angles to the piston pin bore. The piston is fitted with an 0.010 in. wide piston ring in two grooves. The two upper rings are flat-faced compression rings chromium plated on the outside diameter to a depth of 0.0007 in. (See Fig. 20.) The third ring is a tapered film compression ring controlled with the ring pump side down. There are two oil rings on several rings in the fourth groove. These rings are constructed so that, in addition to the oil-film lower side film, the outer face is reduced at the upper side and stepped to form oil drainage areas below the oil-ring rings. The fifth ring, which is below the piston pin, is a typical oil-ring design. A relatively narrow head (0.02 in.) is provided above the upper compression ring. The seat two heads are 0.17 and 0.18 in., respectively. Ring side clearance is approximately 0.001 in. in accordance with American practice. Ring rings are fitted closely (0.001 in. in 0.15 groove, and 0.002 in. in fourth groove) with progressively increasing diameters located the piston head (0.001 in. in the third groove and 0.002 in. in groove one and two). All rings have parallel side faces and approximately 0.2 in. axial depth. The piston pin (Fig. 21) is a low-alloy steel hardened throughout to Rockwell C 58. It is not case-hardened. The piston pin is retained by means of 150 aluminum-alloy pins ground into the pin. The heads of these pins are relatively thick and the spherical contacting area is decreased by a large shoulder. Two angular holes through this shoulder serve the dual purpose of venting the gas and providing cooling means.

VALVE GEAR—The cam is a double-track ring running on a fulcrum and bearing of very good quality steel, is held in a pin fit on a ledge of the web-hose intermediate front timing discharge. The cam is machined to Rockwell C 48. Core hardness is Rockwell C 32. The drive is through a pair of spur gears from the crankshaft to the intermediate cam drive. This intermediate cam drive is mounted on a shaft shaft on the revolved front main discharge and is made as a cluster gear incorporating a pinion which drives the internal gear integral with the cam. A bronze bushing in the cluster gear completes the assembly. It is interesting to note that no lock is provided on the cam which retains the gear, addition



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DELCO MOTORS
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being such that the right-hand thread is engaged in tighter during engine operation. This gear loses power for less rotation at one-sixth crankshaft speed and as a division opposite the crankshaft rotation. Three lobes on each cam lobe provide for operation of all four main exhaust and all fourteen intake valves. As was noted previously, cam lobes and tappets are tilted at an angle of 34 deg 39 min. to provide more nearly straight line action of the push rods and tappets. Thrust coming from the cam is taken through the flange of

the cam bearing ring to the intermediate thrust motion dampener. As a result, the dampers have found it permissible to rotate the cam by three sheet metal pins each held by two studs which pass through holes in a second flange on the cam bearing ring. Close gear for the internal cam gear is provided underneath the dampers.

The cam is driven with constant velocity pick-up and output ratios for a running clearance of 0.005 in. to 0.008 in. at 2500 rpm, picking up and losing velocity of both intake and exhaust

valves in 150 fpm. The cam design gives 34 deg overlap, 364 deg of inlet opening, 280 deg of exhaust opening. Timing is approximately as follows although no accurate check was not made. Inlet opens 20 deg early, closes 84 deg late, exhaust opens 36 deg early, closes 20 deg late. Valve lift is 0.51 in.

Tappets are arranged in pairs in 16 178 aluminum alloy tappet guides (one per cylinder). A great deal of work was done to cut these guides out of what must have been extremely tough forgings. They are bored and slotted liberally for various reasons noted in all three drawings. Tappets are Rockwell C 60 diameters, although the photographs show a change in structure near the surface. They are 0.64 in. diameter and are fitted and ground in ball sockets for push rod retention. Tappet rollers, 1.25-in. diam steel (Fig. 23), are Rockwell C 61 throughout and are mounted on 0.28 in. diameter cam followers (Rockwell C 60 one, 34 over) during run. Push rods are low chrome alloy steel along with precision ball rods of low alloy steel heat-treated to a hardness of Rockwell C 56, except at the tip which is quenched to obtain a hardness of Rockwell C 60. Fig. 25 shows a section of the push rod ball end. Push-rod bearings are aluminum alloy etched in areas of a push-rod gland type joint in the cylinder rubber cup. There are no lower push-rod bearing assemblies available when the engine was imported, but photo graphs of a similar engine indicate a single piece which forms equivalent for low push-rod bearing and, in turn, attached to the crankcase by the three studs which also retain the tappet guide block.

Valve makers are machine placed steel dampers of the alloy described previously (See Fig. 26). They monitor on precision-laminated glass fire-brake bakings ground and ground into a bore in the stem. There also is a tapered steel journal supported by a stepped roller bearing ball (Rockwell C 56) taken by the bearing flange against a shoulder on the journal. The push rod ball socket is permanently installed in one end of the roller. Adjustment is at the roller end by means of a screw threaded into the stem and locked by means of a pin nut. A drilled ball bearing on the valve stem and is welded in the adjusting screw, providing a finished type of construction.

Ball-and-rod, stem exhaust valves (Fig. 30) and the ball-and-rod head solid stem intake valves (Fig. 36) are used. The exhaust valve stem is the high-chrome, high-elasticity type and which alloy generally used in this application. It is forged and quenched. (Turn to page 277)



Speaking of Responsibility

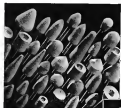
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(Continued from page 214)
is one piece with added riblike lip and flange. Five and ten lankers in Rockwell C 56, size, Rockwell B 60, and ten, Rockwell B 60. Metallic sodium is used as a coolant. The relief valve has four dimensions with 132 percent tungsten, 52 percent aluminum, 64 percent nickel, 93 percent cobalt, 04 percent molybdenum, 62 percent, and 84 percent carbon. It has a thickness of Rockwell C 20 to 45 with the lip hardened to 55.

Major valve dimensions are as follows: exhaust, 2.55 in. diameter head, 45-deg. face. Inlet diameter 2.55 in. diameter, 157 in. diameter head, 45 deg. face, 0.43 in. diameter stem. Valves and cam seats in the cylinder head is combined generally. The lower intake seat is 2.75 in. OD by 2.54 in. ID, the steel seat head seat is 2.67 in. OD by 2.54 in. ID. Valve seating apparatus are oriented by a split lock interlocking a tapered 149 and a tapered ID which fits three concentric rings—lower pressure in the valve stem. Two springs are used per valve—the main spring on a weaker in the guide flange and the outer on a loose end member in the cylinder. Springs are cushioned placed, cushioned with a thickness of Rockwell C 60. Quality is very good.

REDUCTION GEAR—The 17.1 propeller reduction gear is of the planetary type, parts are shown in Fig. 27. A large internal gear with 51 teeth is splined to the crankshaft front extension as described previously. This gear is of fine pitch construction, being such up of a deeper splined with the splined hub. The external gear gear is attached to the OD of the frame by means of a large number of small diameter through bolts. The rear and frame are Rockwell C 62. Case hardness (including lips) is C 36. The 36 tooth gear gear of this planet set is attached to the crankshaft front section by through bolts in the crankshaft section. Bolts and flange of this gear set Rockwell C 56. Case hardness (including lips) is C 36. (See Fig. 26.) Unfortunately, as mentioned previously, this section is not available for inspection. The Rockwell plant gears are mounted on transverse pinions into a modified oil split ring. Pinion roots and flanks are Rockwell C 58. Case hardness (including lips) is C 40. One depth is 0.415 in. Transverse (Fig. 26) are low-alloy steel reinforced on the journal surface only to give Rockwell C 58 on the root, 41 on the root, and a case depth of 0.415 in. Pinion case is ground in steel-hardened copper lead lead bearings. The housing is 0.415 in. thick, of some structure but extremely of very good quality and satisfactory in its purpose. The pinion set is splined to the propeller shaft and mounted in place by a large nut. The propeller shaft is

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the steel mentioned previously, as being similar to A359-0254. It is included throughout by Rockwell C 39. The proper attachment is not common to American standards. Splices are in various types—24 angle and one wide splice on the base of 24 splices. Outside diameter is 3.75 in. and splice depth 0.132 in. Cut end diameters are 3.58 in. for the large end, and 3.22 in. for the small. A line, wide underside is machined between the latter and the splice ends. Pop rivets are threaded in 1/8 in. pitch x 30 mm diameter. A

small gear is bolted to the pinion gear to provide some type of drive on the crankshaft front section. This gear forms the basis for the inspection mentioned under discussion of this section.

SUPERCHARGER ASSEMBLY—A gear-driven centrifugal supercharger driving at 8,800 r/min shaft speed is incorporated in the engine. The drive is accomplished in a manner very similar to that used on the American engines. The same sprocket drive and timing shaft, driven through a splined coupling from the rear main bearing journal and

running in a bronze bearing in the supercharger rear cover, serves a number of purposes (See Fig. 30). The link for a spring loaded supercharger drive gear is integral with the shaft. The supercharger shaft rides on two steel bushes, copper lead lined bearings on each side of the shaft. The shaft itself is of the material described previously having a new bearing of Babbitt C 36 and a case of 20 at wear points. The crankshaft supercharger drive is coupled by a cast-iron intermediate drive member mounted on a shaft fixed to the supercharger rear bearing and pinned in a locked hole in the supercharger rear cover. This intermediate drive member incorporates a copper-lead lined, steel-bushed bearing. The 125 aluminum-alloy impeller is mounted on square spacers on the impeller shaft just mentioned. A steel bearing is incorporated in the impeller bearing diameter is 0.62 in. Impeller design is conventional with 12 vanes, apparently standard and best per American practice. A 14-vane supercharger diffuser plate of magnesium alloy (Fig. 31) is mounted by means of 14 screws in a supercharger rear housing flange. Flange intake pipes are taken independently from the exhaust manifold between the supercharger front and rear housings, the oil intake plate and the diffuser plate. The supercharger entrance passage from the manifold is unobstructed but appears to be slightly small for an engine of this size. Axial clearance in the exhaust is 1/8 in.

Supercharger oil sealing is accomplished by two cast-iron plated cast-iron primer rings in impeller shaft spacer grooves at either end of the impeller. The rings and spacer shaft drive tightly fixed into the supercharger rear housing and the replacement of bulk parts. (See Figs. 31 and 32.) It is interesting to note that a line for venting the supercharger oil and a vent into the supercharger rear housing but left unvalved.

ACCESSORY DRIVES—The 30 tooth spring-loaded accessory drive gear mentioned previously also drives all of the accessories except the magnetos through a centrally located 20-tooth idler gear to: (1) a 39-tooth generator drive gear and shaft, (2) a 30-tooth oil-pump drive gear and shaft, (3) a 30-tooth accessory gear box drive gear and shaft. An 8-tooth spiral gear is meshed into the oil-pump drive shaft and actuates with a 3-tooth spiral gear on the fuel pump drive shaft. This forms a lateral fuel-pump drive on the left side of the engine at 1/12 engine speed. The square shaft and output pulley, formerly standard on American engines, are used for the fuel-pump mounting.

(Turn to page 262)

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Magnetic drive (Fig. 33) is accomplished from a 30-tonk after gear integral with the crankshaft's eccentric through an intermediate magnetic drive shaft, which runs in two journal bearings in the supercharger housing. Machined internal with this shaft are a 28-tonk after gear and a 14-tonk before gear. The level gear mesh with the 30-tonk level gear and magnetic shafts mounted laterally because limited support bearings which are, in turn, mounted in the supercharger housing. (See Fig. 33.) No oil seals are provided. Three oil seals mounted externally are mounted on either side of the gear housing and are driven through a splined coupling engaging the female splines in the magnetic gear shaft.

LEAKAGE-STOP SYSTEM—A three-stage oil pump comprising a pressure pump and two suction pumps is mounted on the rear cover. Oil from the pressure pump is taken through passages in the supercharger housing and a flow type oil strainer to the large volume tank in which the oil is propelled out of the crankshaft's external tank. Oil transfer to the drilled crankshaft ends is accomplished through slots in the housing and drilled holes in the shaft journal. All forward engine lubrication is taken through this journal and on through the drilled passages in the crankshaft. Modern connecting-rod bearing lubrication was mentioned previously. Knocking-pin oil is fed from the master rod bearing clearance. Drilled holes drilled into end of the bearing. These holes in the shaft connect holes drilled in the oil and flanges and thence to corresponding holes in the hollow knock pin. Piston pin lubrication is by splash. Holes for this purpose are drilled in the articulated rod eye near the crank, and in the bottom of each pin between the piston.

Propeller crankshaft gear oil is taken from the hollow front crankshaft journal and propelled shaft through holes in the splined record for the piston rings and on through drilled passages in the hollow piston crankshaft.

Valvegear lubrication is through a suggested chart and a spring loaded hole to the intermediate main drive gear housing. Oil flows through a slip joint to the crankshaft front intermediate valve displace and drilled passages thence to the cam ring and valve tappets. (See Fig. 33.) Pressure of oil is metered to all plan valve bearings through passages in the tappet, push rods, and valve coxers.

Assurance drive is lubricated through drilled passages in the supercharger rear cover leading from the rear oil tank around the crankshaft external tank.

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sule of the rear cover. Oil from this sump is led through drilled passages in the supercharger housing and crankcase front sections and through tubes in the pressure main sections to a journal type seal on the propeller shaft. The seal is mounted within the crankcase section. A spun tube in this area regulates the two positive hermetic propeller seal systems. A diaphragm on the propeller shaft operates propeller seal in the forward part of the engine oil in the after part.

Severing of the main portion of the

engine is accomplished by drainage to an oil sump mounted at the bottom of the supercharger front housing. The main scavenger section of the oil pump draws oil from this sump and discharges it to the external system in the scavenger tank section. The third section of the oil pump takes motor oil from the oil sump and discharges it to the external tank section of the engine. Oil from the motor tank on Cylinders 1, 2, 3, 4, and 7 and oil on Cylinders 4, 5, and 6 runs down from the tank into this sump. Upper cylinder

bores drain through push-rod housings and tappet guides directly into the scavenger tank compartment.

INTERESTING AND MISCELLANEOUS—Information on structures for this engine is very meager.

An electric motor starter is mounted on the mechanical shaft-hall starter pad and supports a three-pole end of the mechanical engine.

The engine photographs, Figs. 36 and 37, presented herewith are believed to be from a magazine similar but not that used with this engine. The reviewer of the engine system is unable to identify a magazine very similar to American engine, including operating plans and engine containers in the operating well. Identified with the complete engine is an interesting quick document listing a link order is possible to receive the whole thing from the magazine without disturbing the basic and not abundant from very good through each of the blades, however, as mentioned before, this equipment is not from the engine on which this report is based, but represents an engine which is in use.

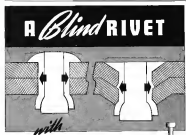
No combustion data on this engine are available to the writer.

An auxiliary drive-gear box, Fig. 38, is mounted on the right-hand side of the rear cover. This box houses the drive for a single tachometer and two ammeters, the system of shafts is not known. This drive involves a small spur gear (probably twelve teeth), which is not made of steel, and is applied to the right-hand auxiliary drive-gear shaft. Fig. 39 shows drive parts. It makes with a 30 tooth gear mounted in the auxiliary drive housing, and applied to a shaft mounted in a level gear. Tachometer drive is through a spiral coupling directly from this shaft. It is 0.6 meshed speed (if the driving gear contained eight teeth). A square-pole drive is applied to the in-pump drive on American engine and a telescoped drive is incorporated through two level gears each making with the gear on the main shaft.

The action of the drive used on the crankcase front section is not known, but it is believed that a combination run mechanism operates governor and constant-speed propeller governor drive to make available at this point on late engine.

The oil pump is mounted at the left-hand of the engine, taking its drive through a splined shaft of the pump and fuel pump drive shaft mechanical assembly. Parts are shown in Fig. 40. A magnesium alloy bearing is used for oil pump and fuel pump shafts and shafts. The 112 in. type shaft crank scavenger gear is applied to the engine shaft and drives the main oil

(Turn to page 265)



with POSITIVE MECHANICAL ACTION

A great many aircraft manufacturers have found that Cherry Blind Rivets offer a highly practical solution to blind spot riveting. Millions of these rivets are flying in America's combat and commercial planes. Cherry Rivets are made of aluminum alloy, require no backing bar, and are applied easily and quickly. They have positive mechanical action, giving high shear and fatigue values to the finished rivet.

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Manufactured Under U.S. Pat. No. 2,183,543

Also shows the proper set also Cherry Rivet before and after application. Also note in the below type all are applied with other hand operated or pneumatic guns.

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(2) decreased Papaverine

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UNITED AIR LINES

1

Such cost is proportional to the difference in weight, assuming that the strength and system speed remain constant. As the ratio of thrust lift required increases proportionately to the 1.5 power of the flying weight ratio, it is found that an additional 1,000 lb. of empty weight means, roughly, a 45 per cent increase in hourly fuel consumption.

It is one of the principal factors which affect the whole-range rate of transport aircraft and, therefore, it serves the most serious manufacturers from the concept designer. It has been common, in the past, of the importance

of structure weights, but has given as sufficient thought to the general relationship between such important elements, and the engine as a whole. I might say, for instance, that wheels, tires and landing gear have been too small on past transport airplanes and this has almost inevitably, a serious payload penalty shortly after the reduction of our own surplus in transport service.

During the last year additional weight increases have become effective, and there will shortly be noticeable benefits of regulations promulgated to improve the safety of flight. For instance, new stress on substitution of 25 percent ex-

cess design basis for the present 5 percent savings standard, except wind-tunnel tests and improvements in the production as indicated by recent Civil Aeronautics Administration. For practical tests at the National Bureau of Standards. Another item which adds 200 lb. to the structure of the DC-3 is the former in the previous for one-meter flying to obtain the necessary buoyancy in case of landing on the water surface.

To offset these weight increases, improvements have been made—some for the same reason. Among such improvements may be noted the substitution of lighter and more efficient propellers and new alloys after design, giving greater comfort and providing the elimination of excessive vibration. Engineers have also indicated that the amount of oil carried aboard can be reduced without loss without affecting reliability and at a saving of 200 lb. per airplane.

It is anticipated that when newer and larger airplanes in scheduled air service, engine weight increases during the last year or two of operation may be necessary, but it is our belief that without general knowledge of air transportation and improvements in structure, specialization in other components and greater cooperation between the manufacturer of the airplane, the manufacturer of the engine and the airline operator, the percentage is weight increase for these new airplanes may be reduced substantially.

In order to insure proper control of the empty weight of transport aircraft in operation and as requested by the Civil Aeronautics Administration, each engine model and its established performance the resulting change which effect both empty weight and balance.

In the case of Eastern Air Lines, on Engine Change Form (Fig. 1) is used by the Manufacturers Department to record all engineering changes which are made on the first. Whenever an engine has a weight change, a copy of the Engine Change order on which the estimated weight change is recorded is sent to the Weight Control Department. When the alterations have been made, the actual weight change is recorded and the Department which makes the change notifies the Weight Control Department accordingly. The weight change for each engine location is then recorded on the weight change chart for the airplane on which the alteration was made.

For alterations or repairs which do not require the services of an Engineering Change, but involve, nevertheless, an increase or decrease in empty weight a weight change report form is used (Fig. 2). On this form the department making the alteration or repair records (Turn to page 28).

28 Tons Sitting on Nothing



TO FILL THIS 28-TON LEVIATHAN into the air—no job it flying—requires engines of super horsepower—engines that didn't exist, except as a drawing board, not so many months ago.

How the power of 1800 horses can be compressed into an engine hardly wider than your outstretched arm—how this terrific force can be delivered to turn a propeller at the end of a shaft is one of America's industrial genius.

A secret of the modern airplane engine's might is gears—gears to light in weight, ground to such close tolerances that engineers almost despaired of ever producing them except under laboratory conditions.

But the urgency of war demanded that these gears be mass produced at no sacrifice in lightness or precision. Today in the plant of Foote Bros. Gear and Machine Corporation these "jewels of power transmission" are flowing out to help power American planes.

All this meant new manufacturing techniques—new production methods. American manufacturers may look forward with confidence to the application of these developments to peacetime speed reducers and gears to assure better machines—quicker machines—produced at lower cost.

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Radio chatter in the Mexican desert.

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Two-way radio communication is a vital factor whose importance is magnified by today's events around the globe. Not only do air-for-fighting forces coordinate their operations through the maintenance of radio communication—but we, at home, are supplied with constant information concerning their activities.

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Manufacturers of Aircraft, Marine and Mobile Radio Communication Equipment

NEW YORK, N. Y.



WASHINGTON, D. C.

BUT WAR BOMBS AND STAMPS

(Continued from page 364)
the weight change and also its location. This data is also mailed to the Weight Control Department for proper record on the airplane weight change card.

When alterations or repairs are performed for which a report to the Civil Aeronautics Administration on their No. 201 form is required, this report is mailed to the Weight Control Department before being submitted to the Civil Aeronautics Administration. When the report is checked to insure that all weight changes have been recorded, after which it is stamped and returned to be mailed to the local Civil Aeronautics Administration office. If there is no weight change and/or order of gravity movement, the report is stamped "No weight change or e.g. movement as indicated on this report." If there is a weight change and/or e.g. movement, but such change does not necessitate an order or revision of the loading chart for the airplane, the report is stamped accordingly. If there is a weight change and/or e.g. movement which makes an order or revision of loading chart necessary, then the report is stamped with the proper notation. If the aircraft has been weighed for a second time after each repair or alteration as specified on the report has been

made, the report is stamped "Aircraft weighed for second time and the actual weight and balance report number recorded."

The Weight Control Department keeps a perpetual record for each aircraft, listing all changes affecting the empty weight. At intervals of time to six weeks the weight record for each step is checked and the e.g. location is indicated. If the e.g. location requires weight change as an airplane closely approaches the limits as specified in paragraph 4.335 of the Civil Aeronautics Safety Regulations, Edition No. 38, a recommended sample balance report is submitted to the Civil Aeronautics Administration.

The following procedure is adhered to for aircraft weighing airplanes:

- 1) Determine tanks and cargo are drained.
- 2) Airplane checked to insure installation of standard equipment in proper location. Unusual equipment checked then is installed as shown on charts.
- 3) All tools, work cranes, jacks, stands, chains and rubber bands, screws, wing nuts, etc., are removed from the airplane.
- 4) Scales are set, balanced and checked. The scales are checked by weighing a given weight, approximately



FIG. 2. The distance between the center line of loading gear and center of gravity must be measured and recorded on the Weight Data Sheet.

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400 lbs. on each platform scale, and each scale must give the same weight indication.

5) The surplus is then pulled on the scales. The landing gear wheel scales are set at such a position that each wheel will be in the center of its scale, thereby eliminating any possibility of wheel landing against the base and causing an inaccurate weight indication.

6) The surplus shown is then added to prevent error in scale readings due to wind.

7) The test of the surplus is raised by means of a jack and a platform scale is placed under the tail wheel. The jack is removed and the weight indication on landing wheel scales and tail wheel scale are recorded. The total of the first readings is the total empty weight of the airplane. (Weight of war loads and an oil tank being less subtracted.)

8) The tail wheel scale is connected and the tail of the surplus raised until the surplus is in the air. Flight position. This position is determined by the use of a carpenter's level across the landing gear on the surplus. The weight indication on each of the scales is recorded, and their sum less tail wheel scale is the total empty weight of the airplane. The weight indication obtained with the surplus is set down positive in scale is a check against the weight indication obtained with surplus in level position.

The distance between the center line of the landing gear scales and center of the center section wing level spot is measured and recorded on the Wright Empty Data sheet (Fig. 3). This measurement is obtained by measuring a line from the center of one landing gear axle across to the center of the other landing gear axle. A plumb line is then dropped from the center line of the center section wing level spot. The distance between the two lines, plumb line and axle line, is measured.

After the airplane has been removed from the scales, the tail on each scale is weighed and recorded on the Wright Empty Data form.

The Wright Empty Data form is completed and from this data the weight of the airplane is obtained.

For example, the D-3 type of airplane two Platform Scales of 10,000 lb. capacity each, one 3200 lb. capacity platform scale with a load scale of similar capacity, a plumb line and line are used.

The surplus is weighed with full oil tanks and empty fuel tanks. No greater error than 5 lb. per scale is permitted.

As transport airplanes grow in size and weight, some other method of determining accuracies, their empty weight will have to be devised, as it will be impractical to actually weigh airplanes.

(Turn to page 383)



WANTED



50 PRODUCTION EXECUTIVES

Must be top-flight men of proven ability, capable of directing the many divisional operations of one of the world's largest aircraft-engine plants.

The Dodge Chicago Plant, division of Chrysler Corporation, now being built in the Chicago area, wishes to have associated with it a large group of men who have demonstrated their specialized talent, executive ability and high character.

The contract held by Chrysler Corporation for the production of aircraft engines is an outstanding commitment in the war program. It requires doing another high-precision job on a mass-production basis.

This gigantic plant will be one of the world's largest under one roof. Machine tools, equipment and facilities will be the finest and most modern. The personnel must measure up to the same high level of individual efficiency.

This war project demands executive supervision of men, materials and machinery on a scale heretofore unknown in industry. The Dodge Chicago Plant, division of Chrysler Corporation, is determined, therefore, to select as executives men who can guarantee the performance required by patriotic acuity and exacting manufacturing standards.

The Production Executives chosen for this painstaking task must be experts, backed by years of proven skill—both technical and managerial. Thousands of able Americans will work under their direction in round-the-clock shifts. Thousands of precision instruments and production tools will be the responsibility of these top men. That is why they all must be exceptionally good!

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Shown above is one of several TANNEWITZ HIGH SPEED BAND SAWS at the Bell Aircraft Corporation demonstrating one of the hundreds of cutting jobs for which these machines have proven vastly superior. With saw blades moving faster than two miles per minute they slip through mild steel sheets or non-ferrous metals formed or flat with the greatest of ease. Built by sawing machinery specialists, these machines are in perfect balance, operate without vibration, are equipped with automatic hydraulic brakes, "spindle change" tires and a number of other patented features shared with no other band saw—great production expeditors in demonstrated in hundreds of outstanding production plants.

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of 100,000 to 200,000 lb. actually, where the slightest strain can seriously affect the accuracy of scale readings. This is a problem which will require some other one thinking for a practical solution.

Weight control is, therefore, very important, not only from the measurement viewpoint but the operator's as well, and it is hoped that the manufacturers of transport equipment will exercise all diligence and care in checking individual parts designed for maximum reliability without excessive weight, bearing in mind a reasonable altitude life without weight changes.

In closing, I think it is my tribute to the director of Aeronautical Weight Engineers for his effect in recommending to speed the grant of weight control and its putting into its standard work to simplify weighing procedures. (See Aviation, June, 1942 page 402.)

Reclaim Rubber

(Continued from page 325)

claim that a third section the same can keep his specifications in which reclaim may be utilized. Most reclaimers expect even are mentioned in describing the type and quality of rubber in terms of a specification similar work to those domestic centers question of hardness and elasticity. This is not possible with reclaim. Add to this a definite uniformity with the characteristics of reclaim and we realize that the average aircraft engineer, unless he has had some special training, would not know where reclaim could be used or how to control it for it, anyhow, if he did know.

All this time reclaim rubber is merely divided into classifications which refer to the kind of scrap from which it was obtained, such as tubes, tires or shoes. Each of these classifications is subdivided to indicate the physical characteristics of the resulting material such as color and weight. Generally speaking, the lighter it is, the more waste it contains. Larger tubes generally make the best scrap. The exact characteristics of reclaim is "controlled" by the fact that the finished reclaimed article has many of the physical characteristics of the scrap from which it was made. Large reclaimers supply about 100 different grades of reclaim.

What is Reclaim?

Reclaim is popularly reported as a method used by automobile manufacturers to substitute rubber articles. Although it cannot be denied that the practice does exist to an extent, it represents only a small portion of the actual work of reclaiming. While reclaim is less expensive for many purposes it



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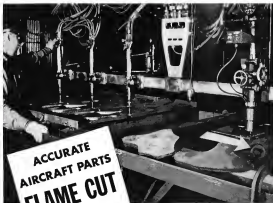


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...with AIRCO GAS CUTTING MACHINES

In one of the Douglas aircraft plants, the small part indicated by the arrow in the photo above is cut with an Airco Oxygen torch—cut so accurately that it requires no further machining! Similar accuracy is also obtained in cutting the larger plates shown. The magnetic inductor follows the template at the right and the torches cut them "to" steel using terminal pieces of one line, producing such a smooth, accurate edge that the only subsequent operations necessary are grinding the flat sides and drilling the necessary holes.

Gas cutting, the first step in the production of many vital aircraft parts, is an extremely rapid operation.

This sheet can be stacked up and cut with multiple torches to produce large quantities of parts in a short time. And the new Airco "45" High Speed Machine Cutting Tips are increasing cutting speed still further—as much as 30% on some operations.

Air Reduction's workable policy is to help American industry do the tough job we all face. Our nationwide field engineering service and our research facilities are at your disposal to furnish "know how" information on any problem involving the acetylene/oxygen flame and the electric arc.

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Available in both shielded and unshielded construction.

Available in both shielded and unshielded construction.

(Continued from page 204)

even spacers are now produced in reams and have proven very satisfactory for purposes that spacers from crabs were generally used.

Certain rubber companies specialize in the production of their products for particular sections. A rubber may be designed specifically for wire and cable, for instance, April cables, hose or military tapes. While it is true that rubbers do deteriorate too quickly to warrant usage over long periods of time, a good system by modern methods should maintain its life for many years. Any rubber compound that can stand up under the conditions that the line faced of an automobile does has sufficient ability to be used in a replacement for crabs and auto hoses and auto structural parts unless there is some definite reason why the application should be avoided.

Specific Aircraft Parts

There are numerous rubber parts in a modern airplane that are being made from high grade crabs which are becoming increasingly scarce, or synthetic rubber, of which there is a shortage of supply. Reams in satisfactory quantities of these products should be used whenever possible. Many varieties of crabs used in aircraft manufacture to show against which the line of any synthetic rubber is satisfactory made of natural rubber. This rubber will be more than sufficient for electrical machine purposes, particularly if it is mixed with a tough epoxy. Hard grips, knobs and pedals, controls can be made of 100 percent neoprene and serve their purpose very well. Cable housing and wiring are covered with the rubber.

The history of use of synthetic rubber in even more general supplies of a compound containing a variety of rubbers. The practice of supplying 100% ASR products of synthetic rubber is well of the short product in a large degree. Lately, some of this material are being used whereas in a great number of applications a rubber product would be more than sufficient. In the meantime the ground will come into contact with gasoline or oil, a synthetic product should be used, but only in those cases. The standard should be changed so that ASR products may be supplied in two styles, one of them contains no more synthetic. In this way a great deal of valuable synthetic rubber would be saved. Almost without exception, products made of neoprene will serve the purposes for which they are intended.



O.K. TO LAND

O.K.—right down to the last check, one to the valve caps that seal the air valves against loss of even an ounce of air pressure.

Released air pressure can account for liquid systems when landing contact is made. An eight valve cap, regardless of the pressure rating, is the valve seal. Every main chassis gas jet in and even though the valve case becomes unusable, an oxygen jet can.

It is easy to understand why Schrader's air and ground hoses, as well as landing communication such as the foot, the Schrader Air Sealing Valve Cap, valve tested with air-tight Schrader Cap can't lose. Pressure test the pressure test all the valves with Schrader Caps.



All Standard Schrader Valve Caps are built with the double reinforced sealing rubber gasket and air-tight to 250 lb. pressure.

REASONS OF THEM THAT HELP SAVE BUDGET

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VALVE CAPS

A SCHRADER'S 100% RUBBER-TOO N. W. Division of Aircraft Manufacturing Company, Inc.



CONTACT!—turn into the wind—and away goes the first silver squadron. Up into the bowl of the sky, wing-tip to wing-tip—up and away, almost as one 'plane, swift into the eastern sky till they seem but glimmering pin-heads stuck in an aure band. Below on the sun-grilled earth great billowing clouds of dust flow slowly across the airfield.

Dust—just dust. But a powerful and dangerous enemy. Our only weapon is filtration, and if full



efficiency is to be maintained, if breakdowns are to be avoided and engine-life prolonged—then that filtration must be **perfect**.

To-day, such filtration is no longer just an idea. Long months of research in the VOKES laboratories have made it an actual, proven fact. These VOKES filters, both for air and for high and low-pressure oil

systems, are designed on an entirely different principle of filtration. Their efficiency—tested and proved under the strictest conditions—is 99.9% (filtration down to particles 0.00004 in diameter). This indeed is perfection. Human endeavour can go no further. Here at last is a guarantee of constant air and oil-purity no matter the conditions of service.

We shall be glad to answer all enquiries and arrange practical demonstrations through our agents.

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We Enlarge and RE-ORGANIZE our MANAGEMENT!

★ ★ ★ ★ ★ ★ ★ ★

It is WITH PRIDE that we announce acquisition of 90,000 additional square feet of factory space, and a sweeping reorganization of active management to care for our increased production needs. As you know, we are producing in factory and airfield, vital aircraft parts for most of the major aircraft manufacturers.

For nearly 16 years we have owned and used one-third of the old Alexander Aircraft Company factory building. We recently acquired possession of the balance of that building.

Management reorganization to cope with the demands of our physical expansion includes appointment of W. L. Maple, former superintendent with the great Chrysler Motors, to St. Louis, Colorado, as general plant superintendent.

In complete charge of Inspection and Salvage, as well as Process Standards, is E. M. J. Wain, for 20 years a prominent Aircraft Engineer on the West Coast, and who for 15 years was in charge of the Douglas Aircraft Company's Inspection and Salvage Engineering departments.

W. B. Marsh, former Production Follow-Up Supervisor for the Murray Corp.

of America, at Detroit, and Ray G. Perrell, who gained his first aircraft experience with the old Alexander Aircraft Co., is 1928, are our new Assistant Plant Superintendents.

Donald C. Howard, formerly manager of our Planning Department, becomes manager of our Production Control Department. Harry R. Elliott, former public relations and personnel consultant for various St. Louis manufacturers, becomes our Director of Public and Personnel Relations.

Ira W. Pike, our Works Manager, has been named to new duties as Plant Engineer.

Our aircraft parts manufacturing and large activities now are housed in three buildings, which give us sufficient room for the easy use of equipment and facilities so that even greater flows of these vital parts will be coming from our production lines.

These improvements mean more... and more... and more... vital aircraft parts for use by our customers in the aircraft that is protecting American lives and interests.

PROCTOR W. NICHOLS, President

AIRCRAFT MECHANICS, INC.
 COLORADO SPRINGS, COLORADO

HOLOPHANE *Planned* LIGHTING

Saves

- * CRITICAL MATERIALS
- * ELECTRIC CURRENT
- * MANPOWER

to Provide

- More GUNS
- More TANKS
- More PLANES

Holophane Planned Lighting achieves economy through control. . . . New with the national effort training for conservation, the flexible control accessories provided by Holophane equipment are even more able than ever. . . . Artificial lighting is part of the "integrated" machinery that produces the "immediate" explosives of war. The more saved on this "immediate" equipment the more available for the immediate effort.

HOLOPHANE LIGHTING Converts WASTE into WEAPONS

- * **CONSERVES MATERIALS:** Holophane Lighting exists as a minimum of critical materials in their construction.
- * **CONSERVES MAN HOURS:** Holophane Lighting, planned for a specific production situation, creates saving conditions that mean less time, less loss per gun laid, less accidents, less errors and less nerve strain. It also effects economies in maintenance time and expense.
- * **CONSERVES ELECTRIC POWER:** Holophane controlled electric incandescent fixtures effective light for essential working areas with minimum current consumption.



SEND FOR THIS BOOK

— *Anodex for war industry executives* — which will show you how to plan the most efficient lighting for how to get the full results of your planning. You'll figure out dimensions and installation for uniform lighting.

SEND FOR BROCHURE ON LIGHTING — This book will show you with every detail in your industrial lighting requirements. Call for this outline obligation.



Holophane
COMPANY, INC. 342 MADISON AVE., NEW YORK

Building Industries, Room 101 HOLLYWOOD BL., 225, 225 N. 10TH ST., SUGAR, CAL.

(Continued from page 294)
very close race even with most efficient management and planning. At the time there is more restriction on the use of released rubber for non-military use. It is the writer's opinion that if the use of released rubber for civilian uses is not curtailed to the least or curtailed altogether, the entire war effort will suffer. It is the writer's opinion that the synthetic rubber program results in a faster rate of production than we are even according to present knowledge. Aside from the fact that the percentage of release may prove to be a valid factor in our war production effort, conservation should be given to its use to conserve conservation simply because in every case it is superior and more economical than natural being used at the present time. What should be done without delay is to determine exactly where these materials are. And then it should be used only in those instances. Let's not get away from the fact that it is a valuable and limited commodity in itself. Until such time as control is placed on rubber production can be established, it is the responsibility and duty of all concerned to make independent studies to determine our economy where rubber use is involved. Let's not let our rubber and control operations and then to take steps to leave the synthetic specifications changed as readily.

Solves the Problem of Mail List Maintenance!

Probably no other organization is as well equipped as McGraw-Hill to solve the problem of mail list maintenance. Our experienced staff of professional writers, editors and statisticians can help you in a wide variety of mail list maintenance problems.

McGraw-Hill Mail List Unit can save you money by helping you to correct errors in mailing lists and to eliminate the need for costly reprints. We can also help you to eliminate the need for costly reprints. We can also help you to eliminate the need for costly reprints.

When planning your direct mail advertising and sales promotion campaign, the efficient and economical service is available to your printed matter on request.

for Results



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DIRECT MAIL SERVICE

McGraw-Hill Publishing Co., Inc.

DIRECT MAIL DIVISION

330 West 42nd Street New York, N. Y.

Three GOOD REASONS WHY Anodex IS SPECIFIED FOR STEEL ENGINE PARTS



● **SAFER** Special ANODEX mixtures have been perfected for the cleaning of steel as used by the aviation industry. . . . specialisation saves valuable materials.

● **FASTER** ANODEX, the original and accepted reverse current process and high concentration, composed, saves time and is easy to install.

● **ECONOMICAL** There are no costly change-overs needed when using ANODEX—rapid action saves money in labor, material, and reduces rejects.

METEX
Aero
COMPOUND
Specialized compound
perfected for rapid,
thorough cleaning of
aluminum and alloys
used in aircraft pro-
cessing.

SALES AND SERVICE
EAST TO COAST
New York, Cleveland, Los Angeles,
Chicago, St. Louis,
San Francisco, Toronto, Canada

FIVE YEARS AGO CALLED "THE BEST" NOW APPROVED "BETTER THAN EVER"

Let us show you how this rapid action process and compound can be used in your plant—better your finished product and speed up Victory production.

Write for Free Data Sheets

MAC DERMID
INCORPORATED
WATERBURY, CONNECTICUT

A NEW CONTRIBUTION TO AIRPLANE SAFETY



A CONTROLLED pH DE-ICING FLUID FOR CARBURETORS, PROPELLERS, AND WINDSHIELDS

• To meet the need for a standardized de-icing fluid that can be used interchangeably for carburetors, propellers, and windshields, U.S.I. announces production of SOLOX® D-I, specifically designed for aviation requirements.

Consisting essentially of anhydrous alcohol, and containing a highly effective corrosion inhibitor exclusively used by U.S.I., SOLOX D-I offers these outstanding advantages:

1. The absence of water in SOLOX D-I prevents formation of free acid, allows better pH control, gives greater moisture-absorbing capacity.
2. The corrosion inhibitor is a liquid — not a dissolved solid. No precipitate can form to clog carburetor jets or coat surfaces.

3. SOLOX D-I blends readily with most fuel supply — minimizes the tendency toward stratification or emulsification.

4. Its high solvent power aids in preventing gum formation and consequent clogging of jets.

5. Its anti-depositing qualities improve engine performance when it is used to de-ice carburetors.

6. It offers the same flow pattern for propeller de-icing as presently accepted de-icing fluid.

7. SOLOX D-I has a high flash point, and its fumes are innocuous, making its use extremely safe.

SOLOX D-I has been approved by manufacturers of the listed equipment, and has been adopted for use by leading airlines throughout the country.

*Registered Trade Mark



U.S.I. INDUSTRIAL CHEMICALS, INC.

60 EAST 42ND STREET, NEW YORK, N. Y.

A subsidiary of U. S. Industrial Alcohol Co. • Branches in All Principal Cities



They work together better...
because they can **talk** together.

In the last war
The pilot's warning
Could only have been expressed
By a frantic dipping
Of the plane's wings

There was no other means
Of communication between
One plane and another.

Today, pilots of our fighters,
Scoring the sky
At better than five miles a minute
Can talk with each other
As easily as if they were lounging
In their quarters below.

The modern radiotelephone
Links every pilot in the squadron.

As the talk goes back and forth
Each man is instantly aware
Of his part in the fight.

Teamwork. The kind of teamwork
That wins battles.

Modern communication equipment
Designed and manufactured
By I.T.&T. associate companies
Is helping Uncle Sam
Coordinate his fighting forces
On land, sea and in the air.

The brand, personnel experience
Of I.T.&T.
In the field of communications
Is proving as vital
In time of war.

INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION 475 Grand St., New York 17, N. Y.

IT&T

Associate Manufacturing Companies in the United States:
International Telephone & Radio Manufacturing Corporation
Federal Telegraph Company



*Here comes the
\$64 Question!*

Are you ready?

What is it, that is new and precise, yet offers the user you will never tire of—ride on it—ride on it—ride on it in a dozen different ways, a dozen times a day—every day of your life?

Come on now, that ought to be easy for you folks who are buying up cars, and searching for old floor mats, busking caps, canvas apples.

Rubber! That's right

—but it will be a synthetic rubber, made in America, by Amstar, Inc. Amstar—a rubber made from a synthetic produced within the boundaries of the United States. Basic domestic materials now produce Hycar synthetic rubber that will never leech.

Right now, thousands of tons of Hycar butadiene rubber are being produced. This Hycar is being processed into literally millions of parts that go into planes, ships, pumps, and the most vital materials of war.

After Vulcan, Hycar synthetic rubbers will continue to replace raw rubber in scores of applications, to make better stations for industrial and domestic use, and make America's houses place in which to live.

Hycar synthetic rubbers are furnished in manufacturing of finished rubber products. You rubber supplier can produce the superior qualities of Hycar. If you are producing a new material, you can develop and improve with steady expansion in speed production and distribution. The best type of Hycar for your particular application. Hycar Chemical Company, Akron, Ohio.

RESEARCH • ENGINEERING • PRODUCTION

HYCAR *Synthetic Rubber*



Problem: How to tuck an extra bomb aboard

To the men who design the guns and specify the materials for jet fighters, give the responsibility of saving the every possible ounce of weight in aerial war material. Make and more of them are coming to Hycar for their synthetic rubber requirements. For Hycar already has superior resistance to oil and grease, heat, abrasion and fire, Hycar has light weight, tensile 15 to 25% compressed with many other synthetic.

LARGEST INDEPENDENT PRODUCER IN AMERICA OF BUTADIENE SYNTHETIC RUBBER

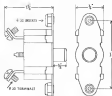
AVIATION, April 1943



Adjusted to the forces of elements for stand-by use. It is approved for use in aircraft where required by the user and manufacturer.

NEW KLIXON PSM Circuit Breaker

for More Convenient Mountings



Has same mounting dimensions as standard AN preferred single receptacle. Note: In ratings below 100 amperes, the base dimensions between lugs for mounting dimensions may be above.

Don't let the big picture fool you. In most "big size", the new Klixon PSM Circuit Breaker is small and compact—mounted right down in the same mounting as the standard AN mechanical single receptacle. With this type of breaker you can hook your switches close together on a panel and mount your breakers directly below each switch. Space saved. Installation is simplified and more convenient to operators.

Like all other Klixon Disc-Operated Circuit Breakers, the new PSM type gives positive shock-proof and vibration-proof position against harmful vibrations but is not affected by harmful transient shocks. It has high tripping capacity. Is available in convenient ratings up to 35 amperes. Self-locking, permits the moving are needed. Can be ordered with plain or luminous-appearing reset buttons. Want for complete information.

KLIXON

SPENCER THERMOSTAT COMPANY • 10 FOREST STREET, ATTLEBORO, MASSACHUSETTS

AVIATION, April, 1943



ARE HIS NERVES OF STEEL O.K.?



We think of Hazard airplane controls as the steel nerves of America's pilots and bombardiers—nerves that must never fail in transmitting thought and instinctive reaction into split-second action.

This conception of our responsibility is reflected in the undeviating quality of Hazard products that help America's war planes maneuver and attack successfully over land and sea—reflected in the performance of LAY-SET Performed Tinned or Galvanized Aircraft Cable and Strand, and Hazard KORROLESS Performed Cable and Strand.

Hazard's aircraft experience includes close and continued cooperation with Army, Navy, and civilian aircraft engineers. Hazard was the first to manufacture Performed Aircraft Cable under license. Ever since 1928 Hazard has produced "KORROLESS" which Hazard originated. Now its plants supply complete aircraft assemblies.

Your nearest Hazard office will give you complete information on Tinned or Galvanized Cable and Strand; KORROLESS Cable and Strand; Hazard TRU-LOC Swaged Type Terminals and Complete Assemblies.

**HAZARD WIRE ROPE DIVISION, Detroit • Fort Worth
Los Angeles • New York • San Francisco • Wichita**



AMERICAN CHAIN & CABLE COMPANY, INC.
BIRMINGHAM, CONNECTICUT

This new name in Fractional HP Electric Motors (.0024 TO .25 HP)



stands for

**QUICK DELIVERY . . . QUALITY TO
SATISFY YOUR PRECISION
STANDARDS . . . SEASONED
FACILITIES YOU CAN DEPEND ON**

Now to you—but an old story to thousands of users of Oster motor-driven appliances—is the 15-year record of Oster as electrical manufacturers. Since 1905, when Oster developed electric motors for its regular line of civilian products, motors for these appliances have been built in the Oster plants.

The complete appliances are approved by the Underwriters' Laboratories and other testing agencies, and are in extensive use by various government departments (including the armed services) in the United States, England, and other countries.

This experience has been sound preparation for building motors now needed for war—in aviation instruments and controls, in tanks and ships and submarines, and in a variety of other applications—without extensive retooling or revision of standards.

Special engineering has been required throughout. Therefore we are equipped to provide you with complete engineering service—including data sheets on motors, re-throw balls, and designs for new motors of desired dimensions, weight, output, and other characteristics within the limitations of our facilities.

Our production experience has facilitated us with government specifications, procedures, and requirements. For quick service and satisfactory performance that is a credit to you, get in touch with Oster Wire, Inc., or phone now . . . John Oster Mfg. Co., Racine, Wis.

SIZE RANGE

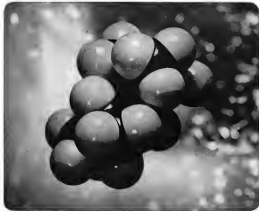
Complete in housing, 2 1/2" dia. to 3 1/2" long to 3 1/2" dia. by 3 1/2" long. Working shaft, series, in split field 3 lead reversible series. Also permanent magnet motors 1" dia. by 3 1/2" up.



OSTER MINI MOTOR
Small permanent magnet motor developed for a special application, since used for varied applications in the war effort. Dimensions complete with housing 1" dia. by 2 1/2" long.



OSTER SERIES A MOTOR
Shunt, series, or split-field 3 lead reversible, 1 1/2" dia. by 3 1/2" long from plate with housing.



Power Booster

LIFTS heavier planes off the ground—carries more tons of bombs—takes them higher, then them further—faster.

The little wooden "toy" above is a chemist's model of *iso* power booster—390,990,600 times life size. It represents a molecule of 2,2,4-trimethyl-pentane (generally known as *iso*-octane), a prime ingredient in modern aviation fuel.

Like many other chemical discoveries now blended to make super-gasoline, *iso*-octane was expensive at first. It cost forty dollars a gallon. Through research and the painstaking development of better manufacturing processes, the petroleum industry is producing enormous quantities today at a approximately twenty cents a gallon.

This development of *iso*-octane is another chemical miracle performed by the petroleum industry in its search for more efficient fuels.

Each year the complex art of making high-octane motor fuels is further advanced—and the possibilities are unlimited.

Ethyl technologists are working in this search. And, since the development of fuels and the improvement of engines are but parts of the same problem—the production of more power from each ounce of engine weight and gallon of fuel—it is our privilege also to cooperate in the research programs of the aviation industry and those of the air services of the Army and Navy.

ETHYL CORPORATION

Chrysler Building, New York City

Manufacturers of Ethyl Fluid, used by all refiners to improve the antiknock quality of aviation gasoline.



TICKING THEM OFF...

Thousands per Minute . . . Millions per Month



AIRCRAFT FITTINGS BY

Volume production applied to the narrow tolerances of the aircraft industry—That has been our outstanding contribution to the War.

The Dole Valve Company started this path early—and went to work. The present rhythm of mass production at Dole Aircraft Fittings represents an engineering achievement.

To set up and maintain the flow without sacrifice of accuracy in machining was a primary step. Beyond that to establish an inspection routine assuring complete work-unity of the finished fittings was the final safeguard—like the Master's plan, and our own experience.

THE DOLE VALVE CO.
3781 MI. Carroll Ave., Chicago
PHILADELPHIA DETROIT LOS ANGELES

DOLE

To Air Corps, Navy and "AN" Specifications



MILITARY
CIVIL
COMMERCIAL
AVIATION

The proper interpretation of aviation has never been more necessary, because never before has it meant so much to so many people. To provide a vehicle that will reflect aviation in its true light we announce the publication

Skyways

FIRST ISSUE NOVEMBER
1943
ON SALE OCTOBER FIFTH
PRICE TWENTY FIVE CENTS
CIRCULATION GUARANTEED
10,000



ARE THE HIGHWAYS OF THE WORLD

J. IRIS HENRY Publisher and Editor
DOUGLAS J. MANTON, General Manager
HENRY LAMB KAY Managing Editor

The present and future progress of aviation, depends on three factors:

MANUFACTURE OPERATION PUBLIC OPINION

Manufacture and operation are those tangible factors that can be compared to the body of the industry, but public opinion is the heart of the industry, without which the body could not exist.

SKYWAYS will be a quality magazine of general distribution.

SKYWAYS will appeal to those actively engaged in aviation and also to those who have an active interest in aviation.

SKYWAYS will be interesting and authoritative, its editorial policy guided by experts in every branch of aviation.

SKYWAYS will cover military, civilian and commercial aviation. Its editorial eyes will be focused sharply on the post-war market.

SKYWAYS will have an excellence of presentation in line with quality magazines published in other fields and will be printed on high-grade coated paper by one of the country's finest printers. The front covers will be works of art using original paintings by the finest artists.

Our ultimate victory will establish control of the skyways for the peace and security of all people—for the development of aviation on the peaceful highways of tomorrow. To this end we dedicate **SKYWAYS**.

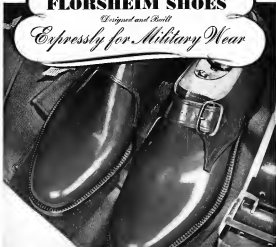
HENRY PUBLISHING CO.
38 ROCKEFELLER PLAZA • NEW YORK CITY
West Coast Office • 5181 Century Boulevard, Los Angeles, California

AVIATION, August 1943

FLORSHEIM SHOES

Designed and Built

Expressly for Military Wear



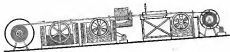
We made them at the request of thousands of reserve officers, who were accustomed to the superior fit, comfort, and wear of Florsheim civilian styles. When called up for active duty, they helped us design a special last to meet all Military specifications: straight inside last, extended rubber heel, arch-supporting shock, and seamless, chisel-toe quarter-lengths. This last is now reserved exclusively for Florsheim Military Styles—the shoes worn today by our Army, Navy, Marine, Air Corps, and Coast Guard officers than any other Quality last! *Where Style illustrated above, \$11.*

PRICE FOR THE LEADER OF YOUR NEAREST FLORSHEIM DEALER OR STORE

THE FLORSHEIM SHOE COMPANY • CHICAGO • Manufacturers of Fine Shoes for Men and Women

AVIATION, August 1943

WAR is engineered scrap



This war machine was built from an old policy, the raw waste of a truck and odds and ends of sheet steel.

It will never fire a projectile nor drop a bomb. But if our enemies really understood America it would frighten them.

The location of this scrapy gadget is to reuse the weather-proofing in electric power wire . . . wire that would otherwise have to be jacked.

But war teaches us to look beyond machines to the hands and minds of the men who make them.

In such perspective the device shown above takes on deep significance. It becomes a revolutionary problem in the possibility of men whose job it is to keep electric power flowing in the vital war industries, regardless of shortages of copper, steel, rubber, aluminum.

There are hundreds of such problems in every war-converted industry. Here are just a few from our great electric power plants:

... tons of belts are being saved by a new method of rigging connections on electric poles.

... a northern generating station found its dam weak—strong. To keep the power flowing, belts were worked through the concrete and the dam belted to bedrock.

... to avoid a shutdown, a middle Atlantic utility worked out a wondrous of snipping leaks around the great valves controlling its water supply by using solder with the water. It worked.

... a western company bought old suspension cables from the wrecked Tacoma Bridge, salvaged them and used the metal in concrete reinforcement.

So goes the saga of electric power, as the industry does its share in the war effort. . . . With much of its trained man-power in the services, with priorities available only in the most urgent cases, the American utilities are showing the steel American management and labor are made of.

McGraw-Hill Publishing Company, Inc. NEW YORK
330 WEST 42nd STREET

WITH A POSTSCRIPT FOR BUSINESS EXECUTIVES

Perhaps you saw the advertisement on the opposite page, in the newspapers.

Did you notice those five examples of the way in which maintenance men are meeting the problem of war operation?

That's what this page is about.

If one public utility maintenance man works out a new way of reconditioning wire, his idea becomes really valuable to the country when all maintenance men with a similar problem find out how he did it.

If one man experiments with solder and bismuth as a substitute for tin solder, that becomes great news for a man who needs tin solder and can't get it.

That's why industry after industry has been able to meet the war production challenge . . . by swapping ideas.

In industry, this idea swapping is done mostly through the editorial and advertising pages of the industrial press.

McGraw-Hill, for instance, keeps 153 editors and 725 engineer-correspondents busy digging up new methods of doing things.

Industrial advertisers, too, often send men

into the field to discover new ways of making their products do more work, or last longer.

When such practical editorial and advertising information is distributed to the readers of the 23 McGraw-Hill publications, the value of each idea is multiplied by thousands.

So valuable is this interchange of technical information that many companies are surveying their organizations to make sure that the supply of industrial Magazines is adequate.

If you would like suggestions as to how to conduct such a survey, just write to Reading Counselor Department, McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York.

THE McGRAW-HILL NETWORK

More than 3,000,000 of the executives, designers and production men, who give America her world reputation in technical "know-how", use the editorial and advertising content of the 23 McGraw-Hill publications as a source of exchanging ideas.

THE McGRAW-HILL BOOKS

Technical, engineering and business books for colleges, schools, and for business and industrial use.

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Engineering & Mining Journal
E. & M. J. Mechanical-Mineral Markets
Engineering News-Record
Factory Management & Maintenance
Food Industries

Metal Supplies
Paper
Product Engineering
Textile World
Transportation
Wholesale & Retailer's

In recognition of the service of our production-men—aligned through the cooperation of American management and labor with the U. S. E. . . this advertisement is published by the McGraw-Hill Network of Industrial Communications.

Write for your free copy
of this Berry Brothers Airplane Book
"WINGS OF VICTORY"



HOW MANY PLANES IN A WING?

Thrilling action in America's No. 1 war industry! 32 pages, beautifully illustrated, with full-color photographs of leading U. S. fighters and bombers, 119 squadron insignia, identification silhouettes of allied and enemy planes, and many other interesting and informative features on U. S. air services and aerial combat! Write for your copy while limited free offers last. Ask for your free copy today!

BERRY BROTHERS
DETROIT, MICHIGAN INDEPENDENCE, MISSOURI

LET'S GO! U.S.A. - WE'LL GET 'EM ANYTIME!

BERRYLOID
AIRCRAFT FINISHES

New **PRESSTITE SEALER**



for Pressurized Aircraft Cabins

*Announcing 3 Additional
New Sealing Compounds
for the Aircraft Industry!*

★ **Extruded Sealer for Synthetic Glass**

Seals joints and cracks in substances as well as synthetic glass—particularly suitable for sealing gas turbine. Stands up under extremely low temperatures. Jointed so sealed are tight for water, air, aircraft fuel, and motor oil. Non-drying, non-polymerizing, permanently elastic.

★ **Fuel Tank Sealer**

Rebuilds cracks of synthetic fuels. Brushes on type for sealing integral tanks and for seams and joints in bolted tanks used for synthetic fuel storage. Will not shrink up to 300° F., remains flexible at - 90° F.

★ **Zinc Chromate Fuel and Oil Tank Sealer**

Formulated in extruded form on cloth backing for easy handling—various widths and thicknesses. Single application. Highly adhesive to metal surfaces even in presence of liquid hydrocarbons. Non-curing, non-polymerizing, resists aromatic fuels.

**Provides Water and
Air-tight Seal**

Withstands Temperatures from minus

- 90° F. to + 212° F.

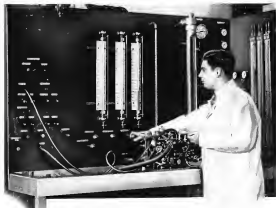
This new Aircraft Cabin Sealer developed by Presstite Engineering Company provides a fast, simple, and long-lasting method of sealing over riveted joints in pressurized high altitude ships.

This sealing compound is of the "brush-on" type and can be applied with a paint brush or spray gun. Tests have shown that it withstands temperatures as low as minus 90° F. and as high as 212° F. and still maintains good adhesion to both polished and also chemically primed aluminum. Flexibility tests between the above limits of temperature show no embrittlement of the compound and no loss of adhesion. It has no effect upon rubber, Neoprene, or Vinylite resins.

Let Presstite Engineering Company solve your sealing problems. Write us, outlining your sealing requirements today.

**PRESSTITE
ENGINEERING
COMPANY**

3910 Chouteau Avenue St. Louis, Missouri



TEST-FLYING A CARBURETOR— on a Bench!

In this world of 314,000 hours we are doing just that every day, at almost equal depth all over the world—wherever *Stromberg Aircraft Carburetors* are checked and serviced. This ground *Bendix-Stromberg* device is a revolutionary improvement in carburetor test equipment as the *Stromberg Injection Carburetor* is an aircraft carburetor.

The *E-Flow Bench* is a test stand on which *Stromberg Injection Carburetors* can be set up and tested. It reproduces accurately, in the carburetor, while the latter is off the engine and readily accessible, any operating

condition that will be encountered in actual use. The performance of the carburetor can be accurately checked and any necessary adjustments can be made on the bench, with the result that when the test is completed the carburetor is in 100% perfect adjustment to operate the engine at maximum efficiency as soon as installed.

Such facilities, plus precision manufacturing methods, explain why the *Stromberg Injection Carburetor* fits with so many of our lighting plants as a member of "The Invisible Crew."

STROMBERG AIRCRAFT CARBURETORS

THE INVISIBLE CREW

Stromberg
Bendix

AVIATION CORPORATION

The *Stromberg Injection Carburetor* is a vital member of "The Invisible Crew"—all the precision built instruments and equipment made by *Bendix-Stromberg* appearing with air flying men on every flight.

AVIATION, August, 1940

Serving with Distinction

In aircraft, tanks, instruments, engines and many varied applications, *Acadia Synthetic Products Division of Western Felt Works* is supplying new and improved materials supplementing critical rubber, tin and copper. Our skilled engineers are ready and eager to help you solve your problems.



ACADIA Synthetic PRODUCTS



With many of the characteristics for which rubber was used when plentiful, *Acadia Synthetic Products* ALSO offers greater resistance to aging, heat, sunlight, alcohol, oil, kerosene and for many solvents. Already widely used for washers, gaskets, diaphragms, etc., unlimited new applications are being found with the co-operation of *Acadia's* experienced engineers.

SARAN® Thermoplastic PRODUCTS

TUBING, FITTINGS,
PIPE, ROD, TAPE
and SHEETS

Saran's properties of moisture, chemical and solvent resistance, tensile and fatigue strength make it highly desirable for unlimited applications.



*Trademark for Chemlok Company

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details on
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products.

ACADIA SYNTHETIC PRODUCTS DIVISION
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Processors of Synthetic Rubber and *Saran* Plastic Tubing and Sheet
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Branch Offices in All Principal Cities



Two hundred eighty-four Wyman-Gordon forgings is this B-24 bomber . . . All laboratory controlled from bar steel to finished product. Wyman-Gordon production of vital forgings for aviation is today 90 per cent of capacity, the remaining 10 per cent, also all for war.



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20	125,000	107,000	10-20%	120-130	170-200
21	125,000	107,000	10-20%	120-130	170-200
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CONCLUSIONS

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AVIATION'S MAJOR PLAYERS

COLLEGE ADVISORS

[illegible]

Lift the Film of "NIGHT BLINDNESS" from your Plant

In war plants all over the land MILLER Condensens Wireway Fluorescent Lighting System has raised the sights on production by lifting the level of illumination to 20 foot candles, 100 or higher . . .

99,000 out of 100,000 war plants have inadequate lighting for fast, precision production . . . according to the National Better Light Better Night Bureau.

Inability to see clearly and sharply at all times can be just as tragic a disability to war workers as "Night Blindness" is to fighting pilots.

Today nothing less than ideal "working" conditions in your plant, 24 hours around the clock, should satisfy you.

Foot Candles will put 50 foot candles, 100 or better of warm white daylight on every working surface in your plant. MILLER THOMPSON will diagnose plant performance in your plant offices and drafting rooms.

They will accomplish this at an economy and speed of installation that

will pleasantly surprise you.

The money you get a **HAIER** engineer on the scene to give you an analysis of exactly the working dimensions you need today, the money you can get here and beat your last year production records. Write or wire today. (Representatives in principal cities.)

BUT U. S. WAR BONDS



THE MILLER COMPANY

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MEMBER, 2004.

American Coast Lighting II Inc. (ALC)

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These Micro Switch Facts Speak Louder Than ANY Words

The type 31 Micro Switch is the Ultimate Lightweight, Sensitive, Precise and Dependable Switch for Aircraft

The facts set forth and illustrated below are only some of the reasons why the type 31 Micro Switch is the ultimate lightweight, sensitive, precise and dependable switch for aircraft. The facts are set forth in a way that will make it possible for you to see the many uses and variety of applications of the type 31 Micro Switch.

It is built to withstand extremes of temperature.

The type 31 Micro Switch is especially well suited for aircraft applications. It is available in single pole normally open, normally closed, and double-throw construction. The U. S. Army and Navy specify it. Sample models, Type W-7-B-1, W-7-B-2, and W-7-B-3 have been subjected to compression and tension tests. The switches are considered suitable for aircraft use.



1. The type 31 Micro Switch is available in a variety of configurations. The type 31 Micro Switch is available in a variety of configurations. The type 31 Micro Switch is available in a variety of configurations.



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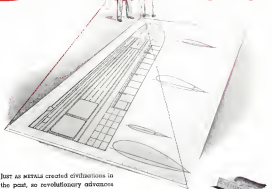


31. The type 31 Micro Switch is available in a variety of configurations. The type 31 Micro Switch is available in a variety of configurations. The type 31 Micro Switch is available in a variety of configurations.



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